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CONTENTS

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AFRICA, ITS PAST AND FUTURE.

AFRICA, the oldest of the continents, containing the earliest remains of man, and the birthplace of European civilization, is the last to be explored. Long before the temples of India or the palaces of Nineveh were built, before the hanging garden of Babylon was planted, the pyramids of Cheops and Cepheus had been constructed, the temples of Palmyra and Thebes filled with worshipers.

Greece owes its civilization to Egypt: its beautiful orders of architecture came from the land of the Nile. The civilization of Egypt had grown old, and was in its decay, when Rome was born. Think what a vast abyss of time separates us from the days of Romulus and Remus! And yet the pyramids of Egypt were then older by a thousand years than all the centuries that have passed since then.

For ages upon ages, Africa has refused to reveal its secrets to civilized man, and, though explorers have penetrated it from every side, it remains to-day the dark continent. This isolation of Africa is due to its position and formation. It is a vast, ill-formed triangle, with few good harbors, without navigable rivers for ocean-vessels, lying mainly in the torrid zone. A fringe of low scorched land, reeking with malaria, extends in unbroken monotony all along the coast, threatening death to the adventurous explorer. Our ignorance of Africa is not in consequence of

its situation under the equator, for South America in the torrid zone has long been known. There the explorer easily penetrates its recesses on its great rivers,—the Orinoco, Amazon, and La Plata,—for they are navigable from the ocean far into the interior. The Amazon, 3,000 miles from its mouth, is only 210 feet above the ocean-level, and, with its branches, is navigable for 10,000 miles. Africa also has three great rivers,—one on each side of this peninsula. On the north, the Nile, the river of the past, empties into the Mediterranean Sea, but its navigation is soon interrupted by five cataracts; so that the camel, the ship of the desert, bears the wares of Europe from the foot of the first cataract far up the river, 800 miles, to Berber, whence they are again shipped by boat 2,000 miles to Goudokoro, close to the lakes Albert and Victoria Nyanza, 4,000 feet above the sea-level, 4,900 miles by water from the Mediterranean.

On the west, the Kongo, the river of the future, empties into the Atlantic Ocean under the equatorial sun; but its navigation is also impeded by successive falls extending from its mouth to Stanley Pool. Then there is almost uninterrupted navigation on the river and its tributaries for 10,000 miles. Far inland the head waters of its north-eastern branches interlace with the waters of the Nile. Another branch rises in Lake Tanganyika in eastern Africa, while the main river finds its source higher up in the mountains, north of Lake Nyassa, 3,000 feet above the sea-level. On the east the Zambezi, the great river of southern Africa, empties into the Indian Ocean opposite Madagascar. The navigation of its main branch, the Shire, is interrupted not far from the ocean. The Zambezi itself is navigable to the rapids near Tete, 200 miles from its mouth; while one or two hundred miles higher up are the mighty falls of Victoria, only exceeded in volume of water by the Niagara, and nearly equal in height.

In whatever direction Europeans attempted to penetrate Africa, they were met by insurmountable obstacles. Communication by water was prevented by falls near the mouths of great rivers. The greater part of the coast was very unhealthy, and, where not unhealthy, a desert was behind it; but these obstacles, which formerly prevented exploration, now stimulate the traveler. The modern explorations of Africa commenced one hundred years ago, when Mungo Park crossed the Desert of Sahara, and lost his life in descending the Niger. From that time to the

present, travelers in ever-increasing numbers have entered Africa from every side. Some who have entered from the Atlantic or Pacific coasts have been lost in its wilds, and two or three years after have emerged on the opposite coast; others have passed from the coast, and have never been heard from. Zanzibar has been a favorite starting-point for the lake region of Central Africa. Stanley started from Zanzibar on his search for Livingstone with two white men, but returned alone. Cameron set out by the same path with two companions, but, upon reaching the lake region, he was alone. Keith Johnson, two or three years ago, started with two Europeans: within a couple of months he was gone. Probably every second man, stricken down by fever or accident, has left his bones to bleach along the road. Drummond, a recent explorer of Africa, chose a route by the Zambesi and Shire Rivers as healthier and more desirable. Let us hear his experience. Early in his journey, at the missionary station of Livingstonia, on Lake Nyanza, he entered a missionary home: it was spotlessly clean; English furniture in the room, books lying about, dishes in the cupboards; but no missionary. He went to the next house: it was the school; the benches and books were there, but neither scholars nor teacher. Next, to the blacksmith shop: there were the tools and anvil, but no blacksmith. And so on to the next and the next, all in perfect order, but all empty. A little way off, among the mimosa groves, under a huge granite mountain, were graves: there were the missionaries.

The Niger is the only river in all Africa navigable by small steamers from the ocean; but the Niger does not give access to the interior, as it rises within 100 miles of the ocean, and, after making a great bend around the mountains of the Guinea coast, empties into the ocean only about five degrees south of its source, after a course of 2,500 miles. Its main branch, the Benue (or "Mother of Waters"), is navigable 500 or 600 miles above its junction with the Niger. The country through which it flows is thickly peopled and well cultivated; but the natives are fierce and warlike, and have until recently prevented any exploration of the Benue.

The Mountains of Africa.

As mountain-ranges determine the course of rivers, influence the rainfall, and temper the climate, we must understand the mountain system of Africa before we can understand the continent as a whole.

Standing on the citadel at Cairo, and looking south, you see a sandstone ridge which gradually grows in altitude and width of base as it runs far away to the south, even to the Cape of Good Hope at the other end of Africa. Successive ranges of mountains follow the coast, sometimes near, at others two or three hundred miles inland; the land, in the latter case, ascending from the coast. The only breaks in this long chain are where the Zambezi and Limpopo force their way to the Indian Ocean.

In Abyssinia, on the Red Sea, there is a range of snowy mountains 14,700 feet in height. A few hundred miles to the southeast, and near Lake Victoria Nyanza, almost under the equator, is another snow-capped mountain, Kilima Njaro, 19,700 feet high,—the highest mountain in Africa,—and the mountains of Massai-Land, a continuation of the Abyssinian Mountains. Another range, apparently an offshoot of the long range from the Red Sea, forms a wall 100 miles long, and 10,000 feet high, on the east of Lake Nyassa, separating the waters of that lake from the Indian Ocean. This range continues to the Zambezi. South of this river the mountains rise 8,000 to 10,000 feet in height. In Cape Colony are several ranges of mountains. The highest peak in Compas Berg, 8,500 feet. In the eastern center of Africa, in the equatorial region, is an elevated plateau in which is the lake region, then there is a sudden rise, and a gradual descent towards the Atlantic. There are few continuous ranges of mountains on the western coast; but at Kamerun there is a cluster of mountains reaching an elevation of 13,100 feet; and south of Morocco some of the peaks of the Atlas Mountains reach an elevation of 12,000 to 13,000 feet, but they have little if any influence on the rainfall or temperature of the country. It will be seen from this statement that eastern Africa has high mountain-ranges rising into an elevated plateau; that the land in Equatorial Africa gradually descends toward the west and north-west until within one or two hundred miles of the Atlantic Ocean, when the descent is rapid to the low and unhealthy coast-lands. Through equatorial Africa runs the Kongo, the land north of the Kongo gradually rising to an elevation of about 2,000 feet, and then descending to 1,200 feet at Lake Chad. South of the Kongo the land rises to an elevation of 3,000 feet, and retains this elevation far south into the Portuguese territory.

Careful computations have been made to ascertain the average elevation of the continent. The mean of the most careful estimates is a little over 2,000 feet. The interior is therefore elevated above the miasmatic influences of the coast, but exactly what effect this elevation has upon the temperature can only be ascertained after careful investigation and a series of observations. North of Guinea and Senegambia the coast is less unhealthy; but, as the Desert of Sahara extends to the ocean, the country is of little value, and is therefore left to the native tribes, unclaimed by Europeans.

In the International Scientific Series it is stated that there are in Africa ten active volcanoes,—four on the west coast, and six on the east,—but I have not found any corroboration of this report, and think it very doubtful if there are any volcanoes now in eruption. The Kilima Njaro and Kamerun were formerly active volcanoes, for the craters still exist. In the south the diamond-fields are of volcanic ash formation.

Equatorial Africa.

The lake region of Africa stretches from the head waters of the upper Nile three degrees south, to the waters of the Zambezi, fifteen degrees south,—a lake region unequalled, in extent and volume of water, except by our lakes. Here is the Victoria Nyanza, the queen of inland seas, 4,000 feet above the sea-level; and a long series of lakes, great and small, at equal elevation. The more striking are Bangweolo to the south-west, the grave of Livingstone, and Nyassa on the south-east. In their depths the Nile, the Kongo River, and the Shire (the main branch of the Zambezi) have their sources.

The great belt of equatorial Africa, situated between the 15th parallel of north latitude and the 15th parallel of south latitude, has continuous rains, is everywhere well watered, and has a rich and fertile soil. Some portions are thickly populated, and it is capable of sustaining a dense population. North and south of this belt there are two other belts of nearly equal width. In each of these belts there are wet and dry seasons, with abundant rain for the crops. The heaviest rainfall in the north belt is in June, while in the south belt it is in December. The rainfall gradually grows less toward the north, and also toward the south, until it ceases in the Desert of Sahara on the north, and in

the Desert of Kalahari on the south. On the edge of these deserts are Lake Chad on the north, and Lake Ngami on the south. North of the Desert of Sahara, and south of the Desert of Kalahari, there is an abundant rainfall, a healthy climate, and fertile soil. Morocco, Algiers, and Tripoli, on the Mediterranean, are in the north region; and Zulu-Land, the Orange Free State, and Cape Colony, in the corresponding region of the south.

That portion of Africa north of the equator is three or four times greater than that south, and the Sahara Desert and Lake Chad are several times greater than the Kalahari Desert and Lake Ngami. The Sahara Desert, the waterless ocean three times as large as the Mediterranean, extends from the Atlantic Ocean to the Red Sea, broken only by the narrow valley of the Nile. It is interspersed with oases, with the valleys of many dry streams, and with some mountains 8,000 feet. It has the hottest climate in the world. Travelers tell us, that, in upper Egypt and Nubia, eggs may be baked in the hot sands; that the soil is like fire, and the wind like a flame: that in other parts of the desert the sand on the rocks is sometimes heated to 200° in the day-time, while in the following night the thermometer falls below freezing-point. In crossing the desert the traveler will hardly need a guide, for the road is too clearly marked by the bones and skeletons that point the way.

Lake Chad receives the drainage of a considerable area of country. In the dry season it has no outlet, and is then about the size of Lake Erie. In the wet season it is said to be five times as large. Its level rises by twenty or thirty feet until it overflows into the Desert of Sahara, forming a stream which runs northward for several hundred miles, and is finally lost in a great depressed plain. In the southern part of Africa the level of Lake Ngami rises and falls in a similar manner.

Through the great equatorial belt runs the Kongo, one of the wonderful rivers of the world. The more we know of this river and its tributaries, the more we are impressed by its greatness and importance. Its principal source is in the mountain-range which separates Lake Nyassa from Lake Tanganyika, between 300 and 400 miles west of the Indian Ocean; thence it runs southerly through Lake Bangweolo. On leaving this lake, it takes a north-west course, running from 12° south latitude to 2° north latitude, thence running south-westerly to the ocean, nearly 3,000 miles. The river Sankuru, its principal tributary, empties

into the Kongo some distance above Stanley Pool on the south. The mouths of the Sankuru were discovered by Stanley, who was struck by the size and beauty of the river, and by the lakes which probably connect it by a second outlet with the Kongo; but he little realized the magnitude of the river. Even before the journey of Stanley, Portuguese explorers had crossed several large streams far to the south of the Kongo,—the Kuango, the Kasai, and the Lomami,—and explored them for several hundred miles, but were unable to follow them to their mouths. In 1885 and 1886, Wissman and the Belgian explorers sailed up the Sankuru to the streams discovered by the Portuguese. The next largest branch is the Obangi, now called the Obangi-Welle, which flows into the Kongo on the westerly side of the continent, a little south of the equator. An expedition organized by the Kongo Free State steamed up this river in the winter of 1887 and 1888, and solved the problem so long discussed, of the outlet of the Welle. The expedition left the Kongo in the steamer "En Avant," October 28, 1887. It passed several rapids, and steamed to 21° 55' east longitude, when it was stopped by the "En Avant" running on a rock, and the opposition of hostile natives. Here it was only 68 miles from the westernmost point on the Welle reached by Junker, and in the same latitude, each stream running in the same direction, leaving no room to doubt that the two waters unite.

The Little Kibali, which rises a little to the west of Wadelai in the mountains of Sudan, is the initial branch of this river, which bears successively the name of "Kibali" "Welle" and "Dora," and empties into the Kongo under the name of "Obangi," after a course of 1,500 miles.

The discharge of water from the Kongo is only a little less than that from the Amazon, and is said to be three times as great as the discharge from the Mississippi. Grenfel, the English missionary and traveler, says there is no part of the Kongo basin more than one hundred miles from navigable water. What the railroad does for America, the steamboat will do for the Kongo Free State on its seventy-two hundred miles of navigable water.

Appropriation of Africa by Europe.

The English, French, Germans, and Belgians have within a few years planted colonies in Africa. They believe it is more for their interest to colonize Africa than to permit their

surplus population to emigrate to America. These countries realize the necessity of creating new markets, if they are to continue to advance. In Africa the colonies must depend upon the home country, and open new fields for manufactures and commerce. They know that in equatorial Africa there are more than 100,000,000 people wanting every thing, even clothes.

The whole coast of Africa on the Mediterranean Sea, the Atlantic and Indian Oceans from the Red Sea to the Isthmus of Suez, is claimed by European nations, with the exception of two or three small inhospitable and barren strips of coast. England occupies Egypt, and will hold it for an indefinite period. France has its colonies in Tripoli, Algiers, and Morocco, and on the Atlantic coast its factories in Senegambia. It seeks a route from Algiers across the desert to Lake Chad, and from Senegambia up the Senegal by steamer, thence across the country by rail to the head of navigation on the Niger, and down that river to Timbuctu.

England occupies Sierra Leone, the Gold and Slave Coasts, the delta and valley of the Niger, and its branch the Benue. It has factories on these rivers, and small steamers plying on them, and seeks Timbuctu by the river Niger. It controls almost the entire region where the palm-oil is produced.

Timbuctu, long before Africa was known to Europe, was the centre of a large trade in European and Asiatic goods. Caravans crossed the Desert of Sahara from Timbuctu north to the Mediterranean, and east to Gondokoro, carrying out slaves, gold and ivory and bringing back European and Asiatic goods.

Sandwiched between the English possessions, Liberia struggles for existence, its inhabitants fast degenerating into barbarism.

Joining the English possessions on the Gold Coast, two degrees north of the equator, are the German possessions of Kamerun, with high mountains and invigorating breezes; but the land at the foot is no more favorable to the European than the Guinea coast. One or two hundred miles in the interior of this part of the continent, the land rapidly rises to the tableland of equatorial Africa, rich and fertile, resembling the valley of the Kongo, possibly habitable by Europeans.

Next, the French occupy the Ogowe, its branches, and the coast, to the Kongo, and claim the country inland to the possessions of the Kongo Free State. Under M. Brazza, they have thoroughly explored the country to the river Kongo, and have established factories at Franceville and other places.

The Kongo Free State comes next. It holds on the coast only the mouth of the river, its main possessions lying in the interior. Belgium is the only country that has planted colonies in mid-Africa. Like all the interior of equatorial Africa, the valley of the Kongo is well watered and has continuous rains. The land is rich and fertile, but is practically inaccessible, and, before any extensive commerce can be carried on, must be connected by rail road with the ocean. The Compagnie du Congo has just completed a survey for a railroad on the south side of the Kongo, from Matadi, opposite Vivi, to Stanley Pool. It did not encounter any unusual difficulties, and has submitted the plans and projects to the King of Belgium for his approval.

South of the Kongo Free State are the Portuguese possessions of Angola, Benguela, and Mossamedes. Portugal, the first of European nations in Africa, was first to explore it, as far as several centuries, and carried on a large trade with Africa, exchanging clothes and blankets for slaves, gold and ivory. It claimed the valley of the Kongo, but the claim has been reduced, and it now bounded for a considerable distance on the north by a line running due east and west on the 5th parallel of south latitude. They have good harbors at St. Paul de Loanda, Benguela, and Mossamedes on the Atlantic coast, and the best harbor of Africa, at Delagoa Bay on the Indian Ocean. Their territory is, I believe, proved to be the most valuable in Africa. It is well watered by numerous tributaries of the Kongo and by the Zambesi and its branches. It is higher than the Kongo valley, and is therefore more healthy. Several Portuguese, English, and German travelers have crossed and recrossed this part of the continent, and the Portuguese have some small settlements on the coast and in the interior. The Portuguese of the present generation have not the enterprise and trading spirit of their forefathers, and are doing very little for the settlement of the country.

South of the Portuguese possessions lie what came from the Portuguese possessions on the Atlantic to their possessions on the Pacific, including Namaqualand, Cape Colony, the Transvaal, and Zulu-Land.

Namaqualand and Damara Land, formerly claimed by the Germans, are now put down on some of the maps as belonging to England. The only part of this coast visited by the English and from the character of the country we are not surprised that

the Germans have planted it, for we are told that "the coast is sandy and waterless, destitute of good harbors, devoid of permanent rivers, washed by never-ceasing surf, bristling with reefs, and swept by a perpetual haze."

North of Zululand, the Portuguese claim the coast to Zanzibar. Over Zanzibar, Germany has lately assumed the protectorate, under a treaty with the Sultan of the country, claiming the land from the coast to the great lakes, then England again, a little to the north and far to the west of Zanzibar, the rivals of Germany in the race. The English have factories west of Zanzibar, and a regular route up the Zambesi and Shire Rivers, [illegible] to Lake Nyassa, and a road to Lake Tanganyika. They have steamers on each of the lakes, and several missionary and trading stations. The worst news from this part of Africa says the route to the lakes has been closed, and the missionaries and merchants murdered.

North of the English possessions, the coast is the German and immediately after the Italian, and so on northward to the Red Sea, which is all claimed by European countries. North of Abyssinia on the Red Sea, Italy has a small colony at Massowa, and Egypt a garrison at Suakin. The only parts of the coast not claimed by Europeans are inhospitable, with no population or cultivation of any kind.

The Belgians have special reasons for the exploration of the Congo and near countries. They have eighteen small steamers making trips from Leopoldville up the river to Stanley Falls, and up to branches, supplying the trade stations in the basin of the Congo. The Congo Free State, unlike all other African countries, is free to all. Merchants of any nation can establish themselves anywhere, and only the same privileges and equal freedom with the Belgians. The valley of the Congo, and the plateau of the great lakes, have a similar climate and soil; and the Congo system of navigation, provisions are cheaper, more readily obtained, and the natives are less warlike. The Congo Free State will therefore be more rapidly settled than any other part of Africa except Cape Colony.

I am truly with these countries as carried on by European enterprise and moral character, will open new markets for many the country and produce of the interior, as well as for trading with them. England, Germany, and Portugal subsidise steamship companies which have regular ports along the western coast, stopping at the different stations.

From this statement it will be seen that England owns the south west portion of Africa (Cape Colony), the most fertile valleys of the Niger and the richest gold-fields in the world and Transvaal; that Portugal comes next among the most extensive portion of equatorial Africa (Portuguese Guinea and slaves of the Congo, but that it is unable to [illegible] was in well-merited ruin and [illegible] French claim Algiers and Senegambia, and are contending with England for the trade of Timbuctoo and the upper waters of the Niger; that Germany, after vain attempts to procure the [illegible] from Kamerun and Angra Pequena, has [illegible] Zanzibar, and has determined to contend with England the lake regions and the great plateaus of Central Africa, while Italy imitating the other states, tries to gain a footing on the Red Sea, with less success.

Plan of Work

[illegible]

known as the allocal class of languages. North of the Bantu are the Negroes proper, occupying the greater part of Africa between 5° and 15° north latitude. The negro tribes are quite indolent, and, though alike in their more physical features, are diverse in their speech.

North of the Negroes are the Nuba Fulah group, apparently indigenous to Africa, but without any thing in common with the other indigenous groups. The name, "Fulah," or "Fulah," means "yellow," and their color serves to distinguish them from the Negro. The Hottentot, Bantu, Negro, and Fulah, though quiet, have much of them the agglutinative forms of speech. The Hamites are found along the valley of the Nile, in Abyssinia, and portions of the Sudan. The Shemites occupy the larger part of the Sudan, bounded on the east by the Nile, and on the north by the Mediterranean and North Africa.

About one-half of the population are Negroes proper, one-fourth Bantu, one-fourth Shemites and Hamites, a few Nuba Fulahs and Hottentots. The Negroes and Bantu are Pagans, the Shemites and Hamites, Mohammedans. There are, amount, innumerable tribes, speaking different languages or different dialects. Over six hundred tribes and subtribes have been classified by Sheba, but such is generally unfitted due to the other Practically speaking, there are but two great divisions, the Negroes and Bantu, occupying equatorial and southern Africa; and the Hamites and Shemites, northern Africa. But there is a clear-cut line even between the Mohammedan and Negro. For many hundred years the Negroes have been taken as slaves, and carried into the north of Africa, and have furnished the harems with wives, and the families with servants. The servants are often adopted into the families, so that the Negro blood now largely predominates even among the Shemites and Hamites.

A broader and more practical distinction than that of language is found in those by the religion of the Africans. The Mohammedan religion was primarily brought from Arabia by the Shemites. They conquered the country along the coast, and established on it, what is the north the former inhabitants. They, by Mohammedanism forced in many cases by the sword or by proselyting. Within the last forty years it has become much its proselyting character, and is now more [illegible] than at any previous time

[illegible] They [illegible] them, [illegible] and often intermarry [illegible] The teach[illegible] Christianity [illegible] and they, and of a future life whose rewards the Negro can comprehend. They [illegible] the sacrifice of human victims to appease the wrath of an offended deity. They forbid drunkenness. [illegible] and thus elevate and civilize those among whom they dwell. The Christian missionary is of a race too far above him. He is a white man, his lord and master. He teaches of things his mind cannot reach, of a future of which he can form no conception, he brings a faith too spiritual; he labours with earnestness and devotion, even to the laying down of his life. Yet the fact remains that Christianity has produced but little impression in civilizing and elevating the people, while the influence of Mohammedanism is spreading on every side.

In passing from the equator southward, the tribes become more degraded. Sir Henry Maine enounced the theory of the evolution of civilization from the lowest state of the savage. In Africa he could have found all stages of civilization, from the lowest grade, man and his mate, living entirely on the fruits of the earth, to a [illegible] made canoes, but only hollow pieces of bark hung from the trees [illegible] from the prevailing wind; the vulture has g[illegible] the previous night, the lion had fallen on his prey, [illegible] having to him the great marrow-bones of the elephant or the giraffe, [illegible] by antelope-flesh; the virgin to numbers, with no competition with his fellow-men, his hand against every man, the [illegible] religion scarcely recognized. It is the end of the gorilla, and there seems to be little difference between the man and the ape, as both are hunted and shot by the Boers. In ascending the scale, the family and tribal relation appears.—A house built of [illegible] and grass or the bark of the tree; a few sticks, skins, nothing more but grass; the world a round stone, burned through, and a pointed stick fastened at the end. Then come tribes of a low order of civilization, that cultivate a little ground, having a despotic king, who has wives without limit, numbering in some cases, it is said, 3,000 wives and slaves slaughtered at his death, to keep him company and serve him in another life. With them human labour is common. Then come tribes of a higher civilization, where the power of the chief is limited, where iron, copper and gold are manufactured, and trade is carried on with foreigners,

where fire-arms have been substituted for the bow and spear; next the Mohammedan; and last of all, on the shores of the Mediterranean, the civilization of the French and English.

It is a curious fact that many tribes that had made considerable advance in manufacturing iron and copper, have for some time ceased manufacturing; that others have retrograded, and have lost some of the arts they formerly possessed. This decline apparently took place after the Mohammedans had conquered North Africa, and sent their traders among the Negro tribes, who sold the few articles the Negro needed cheaper than they could manufacture them, and therefore compelled them to give up their own manufactures. Such was the effect of free trade on certain African. The Mohammedans also manufacture less than formerly, depending more and more upon European manufactures. The enterprise of the white race defies native competition, and native attempts at native manufactures. There is therefore among the Negroes a great falling off in the progress of arts and culture, and the first traces of home industries are rapidly disappearing

[illegible]

One of the characteristics of tropical geography of life. At the head of all life stands man. It is before us in our province to investigate the questions which more immediately concern and affect mankind.

Slavery and its abolishment have, within the last two hundred years, affected Africa more than all other influences combined, and I can only, with its manifold effects, instead of increasing, as I had hoped, to do, call a marked effect not only on the human inhabitants of the mainland, but on the whole industrial and economic life of the whole country. For more than two thousand years trade has made the continent of Africa the battle ground between the nations of Europe have been, and are, large temporal

the Negro make a valuable useful slave. He can endure continuous hard labor, lives on little, has a cheerful disposition, and rarely rises against [illegible]

There are two kinds of slavery,—home and foreign. The first has always prevailed in Africa. Prisoners taken in war are

[illegible] for certain offences, while in some tribes men frequently sell themselves [illegible] masters. They are usually well treated, regarded as members of the family, to whom a son or daughter may be given in marriage, the master often preferring to keep his daughter in the family to marrying her to a stranger. This slavery is a natural institution of native growth. It is said that half of the inhabitants are slaves in the Soudan. The natives of the slave-trade are unknown in this kind of slavery.

In the other case the native is torn from his home, carried to the coast, [illegible] with which he is unfamiliar and [illegible] master is of a different color and of another race, in many cases, where the master and slave have nothing in common. The Spaniards made slaves of the Indians of America, but they were incapable of work, unfitted for slavery, and rapidly faded away. In pity for the Indians, the Africans were brought to supply their places. Their quality to labor was proved, and they were soon in great demand.

It is impossible to ascertain the number of slaves imported into America. The estimates vary from 4,000,000 to 8,000,000. The larger number is probably an underestimate; but these figures do not represent the number shipped from Africa, for 124 per cent. were lost on the passage, one third more on the [illegible] of seasoning," so that, out of 100 shipped from Africa, not more than 50 are to be allowed to survive.

Livingstone, who studied the question of slavery most carefully, estimated, that, for every slave exported, not less than five were slain or perished, and four in some cases only were allowed to reach America. If the lowest estimate is taken there must at least have been 20,000,000 Negroes were taken prisoners or slain to furnish slaves to America. No wonder that many parts of Africa were depopulated.

Though the slave-trade with America has been suppressed thousands are annually stolen and sold as slaves to Persia, Arabia, Turkey, and central and northern Africa. Wherever Mohammedanism is the religion, there slavery exists; and to supply the demand the slave-trade is carried on more extensively and more cruelly to-day than at any previous time. The great harvest-field for slaves is in Central Africa, between 10° south

and 20° north latitude. From this region caravans of slaves are sent to ports on the Indian Ocean and the Red Sea and thence shipped to India, the Persian Gulf, Arabia, Turkey in Asia, and even to Mesopotamia, wherever Mussulmans are found. The English at Zanzibar are a check and hindrance to this traffic; and therefore Ujiji has so often within the past five years attacked Zanzibar, desiring to hold Kaze a port from which to ship slaves to Arabia. Other caravans are driven across the desert to Egypt, Morocco, and the Barbary States. Portuguese slave-traders are found in Central Africa, and, though contrary to law, deal in slaves, and own and work them in large numbers. Cameron says that Arbez, a Portuguese trader, owned 600 slaves, and that on their plantations, having each from 100 to [illegible] wives, were destroyed; and of those not taken, some perished in the flames, others of want, or were killed by wild beasts. Cameron says, "I do not hesitate to affirm that the worst Arabian [illegible] of misery in comparison to the Portuguese and their agents. If I had not seen it, I could not believe that there could exist men so brutal and cruel, and with such gayety of heart." Livingstone says: "I can never more [illegible] recollections of, even, but the slavery scenes come back unbidden, and cause me start up at night horrified by their vividness."

If the chief or parcha of a tribe is called upon for tribute by his superior, if he wishes to build a new palace, to furnish his harem, or if an empty treasury, he sends his soldiers, armed with guns and ammunition, against a Negro tribe armed with bows and spears, and captures slaves enough to supply his wants.

The territory from which slaves are captured is continually extending, for, as soon as the European traveler has opened a new [illegible] into the interior, he is followed by the Arab trader, who settles down, cultivates the ground, buys ivory (each pair of tusks worth about $500 at Zanzibar or Cairo), invites others to come, and when they have become acquainted with the country, and gathered large quantities of ivory, and porters are wanted to carry the tusks to the coast, a quarrel is instigated with the Negroes, war declared, captives taken,—men for porters, women for the harem,—the villages are burned, and the caravan of slaves and ivory takes its route to the coast, where all are sold. We are told on good authority that during the past twenty years more slaves have been sent out than formerly were exported in a century. Livingstone tells us what he has seen:

"In January, 1862, we started from our camp,—200 souls in all,—following the road, sixty feet wide, to a region inhabited by the Basuga, on the Sakura and Lamami Rivers. The huts were about twenty feet square, divided into two compartments, the furniture consisting of cane and wooden stools; floor, coating and walls covered with grass mats. Between the huts were gardens, where tobacco, tomatoes, pine-apples, and bananas were grown. The fields on the river down to the river were cultivated with sweet-potatoes, ground-nuts, sugar-cane, millet, and maize. Goats and sheep and fowls in abundance, I understood for the household in never-ending succession. From half-past six in the morning, we passed without a break through the street of the town until eleven. When we left, it was still extended far away to the northeast. The finest spear was in my opinion such as open-work battle-axes inlaid with copper, spears, and bent arrows, I often saw in use.

"Four years had gone by, when I once more found myself near this same village. With joy we looked upon the broad savannas, where we expected to rest our strength and procure ours. We encamped near the town, and in the morning approached its palm groves. The paths were no longer clear, no laughter was heard, no sign of welcome greeted us. The silence of death prevailed from the palm-trees, and grass covers every thing, and a few charred poles are the only evidence that man once dwelt there. Bleached skulls by the roadside, and the skeletons of human beings attracted the gaze, but no living. Many women had been carried off. All who resisted were killed. The whole tribe had ceased to exist. The slave-dealer was Suwarora, lieutenant of Tippo Tib.

"Sir Samuel Baker was largely instrumental in the suppression of the slave-trade, and, while the rule of the English and French in Egypt was maintained, slavery was greatly diminished; but, since the defeat and death of Gen. Gordon, the slave-trade has re[illegible], and [illegible] has any other time. The only obstacles to this traffic are the presence of Emin Pacha at Wadelai, the English and American missionaries and English trading-stations on Lakes Victoria Nyanza and Tanganyika.

"The slave-traders unite in efforts to destroy Emin Pacha and [illegible] Europeans in the country, except the Portuguese, and for this purpose excite the hostility

of the Negro against the foreigner. In this they are aided by the Mahdi. The work of the Mahdi is largely a missionary enterprise. The dervishes who accompany his army are religious fanatics, and desire the overthrow of the Christians and Emin Pasha as earnestly as the slave-trader. Religious fanaticism is therefore united with the greed of the slave-trader to drive out the Christians from the lake region.

Aroused by these reports, and influenced by these views, Cardinal Lavigerie, for twenty years bishop of Algiers and now Primate of Africa, last summer started a new crusade in Belgium and Germany against slavery and the slave-trade. The cardinal [illegible] and is raising a large fund to equip two [illegible] for Lake Tanganyika and Lake Nyassa, the headquarters of the slave-trade, and offers, if necessary, to lead the band himself. The Pope has engaged in the work, has contributed liberally to this fund, and sent three hundred [illegible] to Central Africa. The slave-trade is carried on with arms and ammunition furnished by European traders. Without these arms, the slave-trade could not be successfully carried on, for the Negroes could defend themselves against slave-traders armed like themselves. While the demand for slaves continues, the slave-trade will exist, and will not cease until the factories of European nations are planted in the interior of Africa.

Mineral Wealth of Africa.

We are told in Phillips's "Ore Deposits" that the precious metals do not appear to be very generally distributed in Africa. More thorough research may show that this view is incorrect, and that there are large deposits of iron, copper, gold, and other metals in many parts of the continent. Gold is found on the west coast, in the Transvaal, in the Sudan, and in Central Africa [illegible] Transvaal; but near all these washings, gold nuggets of large size, and the quartz rock, have been discovered. In Transvaal the mines were worked a long time ago, probably by the Portuguese, then abandoned and forgotten. Recently they have been rediscovered, and worked by the English. In the Kaap gold-field in the Transvaal, three years ago, the lion and zebra, ostrich and [illegible] roamed undisturbed [illegible] where there is now a population of [illegible]

[illegible] paid up. Barberstown, the chief mining town, has two ex[illegible] churches and hotels, four banks, and a hospital. A railroad was opened in December, 1887, from the Indian Ocean towards these mines, 34 miles, and is being rapidly constructed 400 miles further to Barberstown.

There is reason to believe that gold deposits equal to those of Mexico or California will yet be found in several parts of Africa. Copper is known to exist in the Orange Free State, in parts of Central and South Africa, and in the district of Katonga, southwest of Lake Tanganyika, which Dr. Livingstone was about to explore at his last journey. Rich copper ores are also found in the Cape of Good Hope, Abyssinia, and equatorial Africa. Large and excellent deposits of iron ore have been found in the Transvaal and in Algiers, and a railroad 90 miles long has been built to carry it from the Algerian mines to the sea. Very many tribes in equatorial and Central Africa work both iron and copper ores into different shapes and uses, showing that the art must be widely distributed.

One of the few large diamond fields of the world is found in Griqua and Cape Colony, at the plateau of Kimberly, 3,000 feet above the sea. The dry diggings have been very productive, the trout, when first discovered, being almost literally sown with diamonds.

Coal has been found in Zambesi Land, on Lake Nyassa, and in Abyssinia. The latter coal field is believed to be extensive. Iron, lead, zinc, and other minerals, have been found in the Orange Free State. Salt-beds, salt-fields, salt-lakes, and salt [illegible] are found in different parts of Africa.

RAILWAYS.

The peculiar formation of Africa, its long inland navigation, interrupted by the falls near the mouths of the large rivers, from connection with the ocean, render it necessary to connect the ocean with the navigable parts of the rivers by railroads.

The Belgians will soon construct a railroad on the southerly side of the Congo, to the inland navigable waters of the Congo at Leopoldville, following the preliminary surveys lately completed, the French may also construct a road from the coast to

Stanley Pool; and by one or the other of these routes the interior of Africa will be opened.

South of the Congo, the Portuguese are constructing a railroad from Benguela into the interior. In Cape Colony railroads [illegible] the greater part of the British possessions south of the Cape of Good Hope. A railroad is also being constructed from Delagoa Bay to the mines in Transvaal.

Soudan and the upper waters of the Nile can only be opened to [illegible] by a railroad from Suakim to Berber [illegible] miles. Surveys were made for this road, and some work was done [illegible] just before Gordon's death. The navigation of the Nile [illegible] is interrupted for many hundred miles. Below Berber the falls interrupt the navigation. The route from Suakim to the Nile is eight to [illegible] miles to Assuan, boat to Siut, and railroad to Cairo and Alexandria, making a route of [illegible] that [illegible] to any extensive commerce.

In Algeria [illegible] railroads [illegible] constructed. The French are constructing a railroad from the [illegible] to the head waters of the Niger. The English have organized a company to construct a road from the Gold Coast to the mines in the interior.

It will thus be seen that the railroad has already opened a way into Africa that is sure to be carried no more expensively.

Stanley Expedition.

There are two methods of exploring Africa. One is where an individual, like a Livingstone, or a Schweinfurth, or a Dr. Junker, departs on his journey alone. He fixes some tribe as far in the interior, on the line of exploration, as possible; lives with the tribe, adopts its habits and manner of life, learning its language, making whatever explorations he can; and, when the region occupied by such tribe has been fully explored, leaves it for the next farther on. This plan requires time and never-failing patience; but in this way large portions of Africa have been explored. The other way, adopted by Cameron, Stanley, Wissmann, and the Portuguese explorers, has been to collect a party of natives, and at their head march across the continent.

"An immense outfit is required to penetrate this shapeless land, and the traveler can only make up his caravan from the largest

at [illegible]. The [illegible] and [illegible]-makers have made caravaning a profession, and every thing the explorer wants is to be [illegible] from a ton of yard-goods to a repeating rifle. Here [illegible] back various the porters—the necessity and despair of travelers, the scum of slave-gangs, and the fugitives from justice from every tribe—congregate for hire. And if there is any thing in which African travelers are for once agreed, it is, that for lawlessness, aptness, stupidity, and wickedness, these men are not to be matched on any continent in the world." Upon such men as these Stanley was obliged to depend.

Though traveling in this way is more rapid than the other, it is very expensive, and has many difficulties not encountered by [illegible]. The explorers always prefer, if possible, to keep as far as possible the beaten paths. A late traveler says: "The roads over which the land-trade of equatorial Africa now passes from the coast to the interior are mere footpaths, never over a foot in breadth, beaten as hard as adamant, and rutted beneath the level of the forest-bed by centuries of native traffic. As a rule, these foot-paths are marvelously direct. Like the roads of the old Roman, they move straight on through every thing,—ridge and mountain and valley,—never shying at obstacles, nor anywhere turning aside to breathe. No country [illegible] is better supplied with paths. Every village is connected with some other village, every tribe with the next tribe, and it is possible for a traveler to cross Africa without being once out of a beaten track."

But if the tribes using these roads are destroyed, the roads are discontinued, and soon become obstructed by the rapid growth of the underbrush, or, if the route lies through [illegible] outside the great caravan-tracks, the paths are very different from those described by Mr. Drummond, for one may often pass through swamps and morass, or thick woods, or over high mountain-passes, or in boat in a new interpose of waters.

The great [illegible] these expeditions [illegible] to obtain food. As supplies cannot be carried, they must be procured from the natives. Very few tribes can furnish food for a force [illegible] hundred men (the number with Stanley); and when they have the food, they demand exorbitant prices. Often the natives not only refuse food to the famished travelers, but oppose them with such arms as they have; and then it is necessary in self-defense, to fire upon them.

The greatest difficulty the explorer meets comes either directly or indirectly from the operations of the slave-trader. Formerly the slave-trader was not found in upper Africa, but since the explorer has opened the way, the slave-trader has penetrated far into the interior and is throwing obstacles in the way of the entry of Europeans into Africa. When it was decided that [illegible] Tarka, he was left to choose his [illegible] forth, Junker, and other African travelers, in Cairo. They advised him to go by his former route directly from Zanzibar to the Victoria Nyanza. The dangers and difficulties of this route, and the warlike character of the natives, he well knew. The route by the Kongo to Wadelai had never been traversed, and he thought the difficulties could not be greater than by the old route, and, besides, he proceeded much farther into the interior by steamer on the Kongo, which left a much shorter distance through the wilderness than by the Zanzibar route. On arriving at Zanzibar, he made an arrangement with Tippo-Tip, the great Arab trader and slave-dealer, for a large number of porters. They sailed from Zanzibar to the Kongo, where Stanley arrived in February, 1887. He then sailed up the Kongo, and arrived in June at the junction of the Aruwimi with the Kongo, a short distance below Stanley Falls. Stanley believed that the Aruwimi and the Welle were the same stream, and that by following up this river he would be on the direct route to Wadelai. Subsequent investigations have shown that he was mistaken. About the 1st of July he left the Kongo, expecting to reach Emin Pasha in October next. No definite information has been received from him from that time to the present. He left Tippo-Tip in command at Stanley Falls, and expected that a relief expedition would follow. There were great delays in organizing this expedition, from the difficulty of obtaining men, and it was thought that Tippo-Tip was unfaithful. The men were finally procured, and the expedition left Aruwimi in June, 1888, under command of Major Barttelot. A day or two after they started, Major Barttelot was murdered by one of his private servants. The expedition returned to the Kongo, and was reorganized under Jamieson. He was taken ill, and died just as he was ready to start, and no one has been found to take his place; and that relief expedition was abandoned. Reports say that Stanley found the route more difficult than he anticipated, heavy rainfall, rivers, swamps, and marshes ob-

strated the way; that the season was sickly, and a large part of his followers died long before he could have reached Emin Pasha.

The reports of his capture, and of his safe return to the Aruwimi River, are known to us. These may or may not be true. Although we have not heard from Stanley for a year and a half, yet it by no means follows that he is dead; for Livingstone, Speke, and other explorers have been lost for a longer time, and have afterward found their way back to the coast. No one has greater knowledge of the country through which he has passed, or of the character of the natives, or the [illegible] of dealing with them. Emin Pasha was encamped peacefully for nearly two years at Wadelai, and Stanley, in like manner, may have been compelled to remain at some inland point and raise his own provisions.

The Future of Africa

It is rash now to prophesy the future of any country, much less that of Africa, where the physical features have left so marked an impression upon the inhabitants, and where the normal [illegible] is so different from that of the other continents. It is rather by a process of elimination that we obtain any data from which to form an opinion of its future.

Africa, as we have seen, is surrounded by a fringe of European settlements. What effect will these settlements have upon Africa? Will the European population penetrate the interior and colonize Africa? Will it subjugate or expel the African, or will they fade away, like the Indians of our country? If not, will the European nations [illegible] the native inhabitant of the country as barbarian or civilized?

Egypt is now controlled by the English, but its climate is too unhealthy, and its surroundings too unfavorable, for Englishmen to safely assume that their occupation will be temporary, or of permanent, but not extensive. They will remain as [illegible] and rulers, until the subjugated people rise in their power and expel them, and return to their old life. The English are, though possibly homeless to Egypt, hated by the natives, who demand Egypt for the Egyptians.

In [illegible] Egypt, we pass an uninhabitable coast, until we come to the French colonies of Algiers. It is nearly sixty years since

the French took possession of Algiers. There has been a large emigration from France, but the climate, while excellent as a winter climate for invalids and others, is unfavorable for a permanent habitation, especially for infants. The births in one year have never equaled the deaths. When Algiers was first occupied by the French, it was a wilderness, but is now a garden. The cultivation of the grape has been most successful, and extensive iron mines have been opened. The French are gradually pushing their way from Algiers across the desert to Timbuctu, and also from Senegambia to Timbuctu. The ex-

[illegible] Though many doubt the political wisdom of retaining it, yet the French have too much pride to acknowledge that the enterprise has been in any way a failure, and they will undoubtedly hold it, and perhaps found an empire. Senegambia and the coast of Guinea, claimed by the French and English, are low and marshy, filled with swamps and lagoons, which will prevent any European colonization.

South of the Kongo, the Portuguese claim a wide section of country running across Africa. The[illegible] over two hundred years. They have done little towards colonizing, and only hold a few trading posts on the coast and in the interior, dealing principally in slaves, ivory, and gold, and it may well be doubted whether they have the stamina or ability to occupy this country, or to produce any permanent impression upon it.

The south portion of Africa, from the 15th parallel on the Atlantic to the 26th parallel on the Indian Ocean, is generally fertile, and the climate is favorable to Europeans, and is capable of sustaining a large population. The growth of Cape Colony has been very slow, but a more rapid growth is anticipated. We believe it will be permanently occupied by the English, who will compress the aborigines, and form a great and permanent English State. The coast of Zanzibar, occupied by the Germans and English, is rich and fertile, the climate is healthy, but when the mountain-ranges are crossed, and the elevated plateaus and lake regions are reached, it is inferior to that of the Kongo region. Massowa and Suakin, on the Red Sea, are comparatively worthless [illegible] with the upper Nile.

Here remains equatorial Africa, including the French settlements on the Ogowe, the region about Lake Chad, the Kongo

and to mountains, and the lake region. The more we learn of equatorial Africa, the greater its natural advantages appear to be. The rivers open up the country in a favorable manner for trade and settlement. The elevation from 2,000 to 5,000 feet will render it healthy, though this elevation is only equal to from ten degrees to fourteen degrees of north latitude. Here all the fruits of the torrid zone, the fruits and most of the grains of the temperate zone, cotton, India-rubber, and sugar-cane, are found.

The country has been unhealthy, a great many Europeans have died, and few have been able to remain more than two or three years without returning to Europe to recuperate. These facts seem to show that the climate is not healthy for Europeans, that the mortality has been much greater than it will be when the country is settled and the unhealthy stations have been exchanged for healthier localities. Every new country has its peculiar dangers, which must be discovered. When these obstacles are mastered and overcome, Europeans will probably occupy all this region, and it will become a European colony.

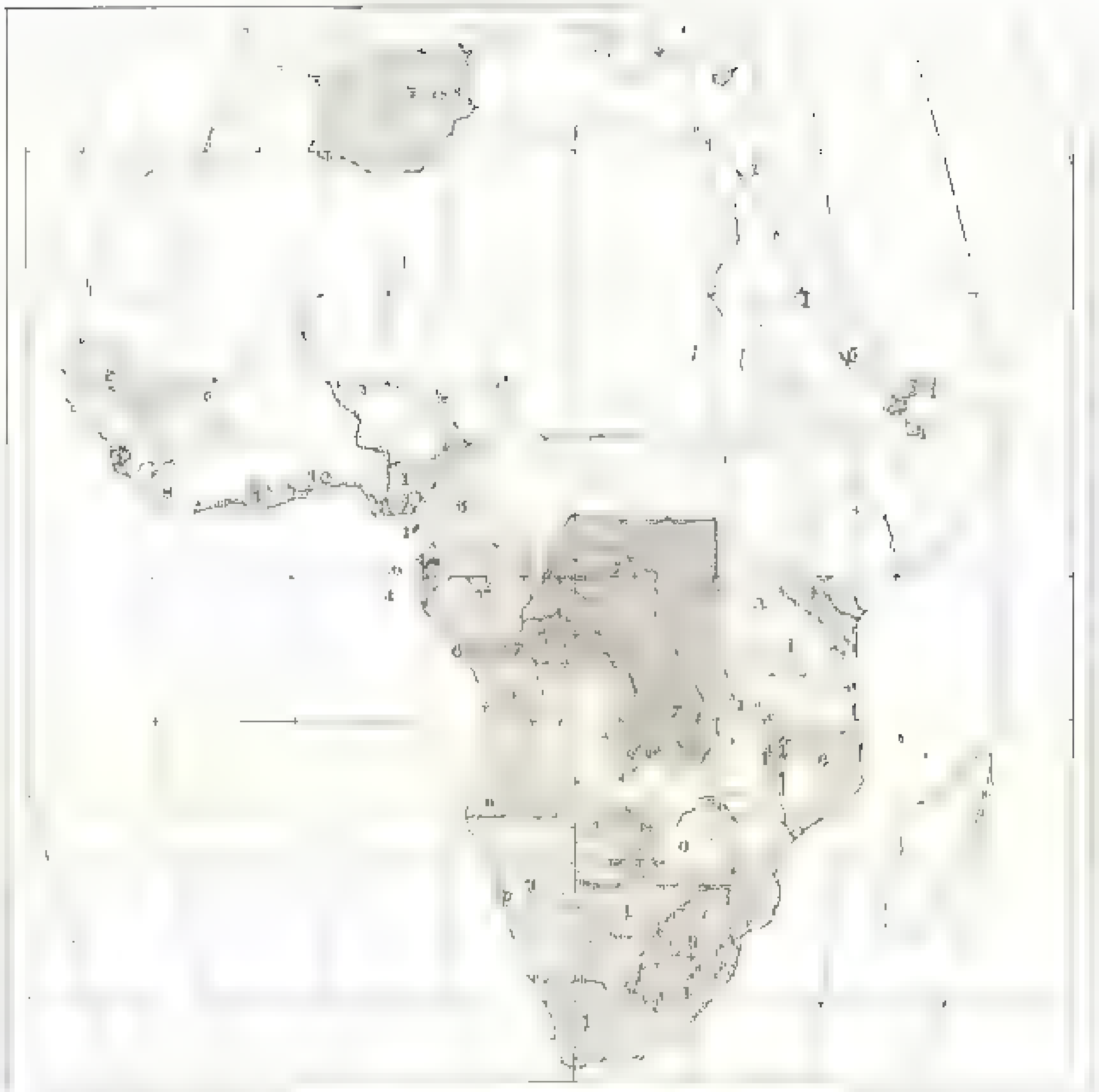
If European colonization is successful, European civilization will come into contact with African barbarism. Where such a contact is carried on in a country where the climate is equally favorable to the two races, it can only result in the subjugation or destruction of the inferior race. If the climate is unfavorable to the white population, then, unless the latter is subjected to the superior, the white population will fail in colonizing the country, and the Negro will either slowly emerge from barbarism, or return to his original condition.

The Negro has never developed any high degree of civilization; and even if, when brought into contact with civilization, he does make considerable progress, when that contact ceases he has deteriorated into barbarism. But, on the other hand, he has never faded away and disappeared, like the Indian of America and the natives of the Southern Archipelago.

Nature has spread a bountiful and never-ending harvest before the Negro, and given to him a climate where neither labor of body or mind, neither clothing nor a house, is essential to his comfort. All nature invites to an idle life; and it is only through compulsion, and contact with a life from without, that his condition can be improved.

In Africa a contest is going on between civilization and barbarism, Christianity and Mohammedanism, freedom and sav-

try, such as the world has never seen. Who can fail to be interested in the results of this conflict? We know that Africa is capable of the very highest civilization, for it was the birthplace of all civilization. To it we are indebted for the origin of our arts and sciences, and it possesses to-day the most wonderful works of man. Let us hope that Africa, whose morning was so bright, and whose night has been so dark, will yet live to see the light of another and higher civilization.



REPORT—GEOGRAPHY OF THE LAND

By Herbert G. Ogden

In preparing this first report as one of the vice-presidents of the Society, I have been obliged to interpret the intent of our by-laws in the requirement that the vice-presidents shall present at the end of the year summaries of the work done throughout the world in their several departments. The amount of information that can be accumulated during twelve months, if referred to in detail, is simply appalling, to compile it for the Society would be a great labor and when completed it would be largely the duplication of the work of others, already accessible in the journals of many societies, as well as specialized treatises on this and kindred subjects. That such a detailed historical journal should be maintained by the Society hardly admits of a question. I have planned to see one inaugurated during the first year of our work that would have embraced all the departments of the Society, but must confess with some heavy punishment, to having been too fearful and to have over-estimated the interest that might be expected to be members of a new organization. We need a journal of this kind for reference, for our associates, ourselves, and our country friends we hope to attract by the information we may supply to them. But it cannot well be compiled by one man engaged upon the every day affairs of life, and I have not made any attempt in that direction, even in those matters to remain confined by the section of the Society under my charge.

I have found little in the affairs of humanity that seems necessary to bring to your attention; indeed the past twelve months seem quite barren of any great events in the progress of Geographic knowledge. This, perhaps is to be expected at intervals of longer or shorter periods, as it is governed by the pace of the most advanced civilizations, who have usually the time, as well as the progress of science to explore and develop the land on which they live, and I turn to the gift of man are to be earned, a less serious obstacle determine new truths to be had by stronger links the truths already found. We may look for the greatest changes here, both now and in the future, in the work of man pressing on

in the eager strife to improve his condition above others less fortunately situated, seeking advantage in the [illegible] his environment to open new channels of trade that will divert the profits from the older routes.

Of many schemes suggested in furtherance of such ends, there are few that develop into realities within a generation. Nature may be against [illegible] may not warrant the outlay, and political considerations may keep in abeyance that which otherwise may be admitted to be good. Thus the grand scheme to make an inland sea of the Desert of Sahara [illegible] many hundreds of [illegible] The project of project to cut the Isthmus of Corinth, now accomplished, was a theme of discussion for twenty centuries or more. And the [illegible] through the fears of a few timid men. Perchance the grander one, now introduced with some seriousness, to bridge the channel, may meet with a better fate.

The route for the ship canal to connect the Baltic and the North Seas, is reported to have been determined upon and the [illegible] Danube with the Baltic Sea by way of the [illegible] chimerical such a project may seem to us, we cannot at this time disturb those who believe in it. It shows that restless spirit that [illegible] for the master of the [illegible] change, but those conversant with affairs apprehend a military catastrophe at no distant date, that will probably subdue the stronger nations and endanger the existence of the weaker ones.

[illegible] knowledge of [illegible] the people of these nations are diligently seeking to develop greater things in the study of all the earth, and we have thus been formed as a means to this end, what is now known as the International Geodetic Association. The primary object of this Association is to determine the form of the earth. It is an inquiry of absorbing interest, and the geodetic work in America must eventually contribute an important factor in its solution. We [illegible] before the [illegible] States to have representation in the Association. The [illegible]

to both in the prosecution of this important scientific labor.

If we turn to the adjoining continent of Asia, there is still open a large field for [illegible] research. Its [illegible] expected that the book of nature that might be opened would long since have been spread before us; but the exclusiveness of this semi-civilization has been a stumbling-block, until it may be said that the wise men of her nations have lived only that the masses should not learn. Of the Political Geography of this great region we have a fair conception, and of the Physical conditions it may be said we know them generally. Frightened [illegible] part of progressive nations, and a few have even passed the confines of exclusiveness and brought back to us marvellous tales of ancient grandeur. Men have sought disguise that they might tread on the forbidden ground, and many have lost their lives in [illegible]

But the march of civilization is not to be thwarted by the barbarous. They may yet impede it, as they have in the past, but it can be only for a time; the impulse is sure to come, when the thirst for knowledge and power by the antagonistic races will sweep all barriers before it, however strong. The contemplated railway across the continent to Vladivostock may be the ruling stage step in overcoming these refractory peoples and opening their territories to the march of progress. We have seen on our own continent the potent influence of these iron ways, and it is not too much to believe that even in the strange surroundings of the Orient they will exercise a power against which exclusiveness and superstition will be forced to give way.

In Africa we find a different state of things. A great continent believed to contain immense resources, but peopled with dark-hued native races, barbarous in their tendencies, and frequently deficient in intellect, and yet within covering at times a savage grandeur that excites the admiration of the man, while it attracts the interest of the student. We may recall Carthage and Alexandria, and all the wonders of ancient Egypt that live to the confusion of our own day, while those who patterned them have been lost beyond the bounds of even the most ancient history: and I know I [illegible] the boundless domination of the morning of ages, until we are left

only such remnants that our most cultivated imaginations can scarce build a superstructure worthy to raise upon the ruins.

But a new era is opening, the intelligence of later years is spreading over these once fruitful fields, and slowly but surely [illegible] and a time will restore the great advantages that have lapsed in the ignorance of ages. The nations of Europe vie with one another to extend their possessions, and in the mad race for precedence are reclaiming even the waste places as footholds by which they hope to reach the power and wealth they see may be developed in the future. Explorers have brought back wondrous tales that have excited the cupidity of those who profit on the barter of man's products, and vast schemes have been projected to secure the wealth believed to be within easy grasp.

Daring spirits discover new countries, and through the reports of the marvels they have seen, inspire their more cautious countrymen to venture into unknown fields in the hope of gain. The [illegible] upon, encourage, and develop into colonies, that in time may revolutionize a continent, and work a peaceful change in the customs of the world. This sequence of events has been gradually progressing in Africa, and has been greatly accelerated by the discoveries of recent years. A large section of the interior has now been opened to trade and commerce in the formation of the "Congo Free State." It marks an era in the development of the continent that promises to be fruitful of rapid advance. The geographic journals have contained many pages of notes during the year, [illegible] details of these more accessible regions. But there is an area nearly half as large as that of the United States through which the explorer has not yet penetrated, a field of great interest to geographers, but they may have years yet to wait, before they may read the story.

In the East Indies and among the islands of the Pacific there is still work for the Geographer of the most interesting character, and, indeed, for the explorer too. Those who depend upon charts of the great ocean realize too frequently the imperfect determination of the positions of many of these isolated landmarks, and the dangers surrounding them. This is more properly work for governments than for individuals, and we may hope the day is

not far distant, when American officers may again roam the seas in geographic research, and bring fresh laurels to crown the enterprise of our people

The great American continent, the New World as it is called, [illegible] similar—a marked instance of the power of intelligent perseverance to conquer in new fields and bring under man's dominion for his use and welfare every scene of the elements themselves. The last century has shown a branch of one of the old parent stocks, divorced from many of their traditions and left to themselves, imbued with a spirit of progress that has advanced with such giant strides, that in a generation we have seen more strange things than had come upon the world before in centuries. At the birth of our nation the now populous district on the Ohio and the Great Lakes was the "far west," roamed over by savage tribes. The great northwest of to-day was marked upon the maps as "unexplored," and the confines of the continent on the Pacific were known more on the faith of good reports than the knowledge of observation; while that vast territory west of the Mississippi was not known at all, or only through the legends transmitted from the "fathers" who had partly accepted it in following their hunting. And yet within half a century explorers have traversed nearly every square mile, science has [illegible] and instead of a vast region of wandering tribes, we find a civilization, energetic, progressive, and still pressing on to reclaim even that which has been considered waste. Indeed, so rapidly have the choice areas been accepted, that it may be but a few years when none will be left, and the question of over-population may press upon us as to-day it presses upon older nations. While this state of affairs may not create present alarm, it is a matter of congratulation that the Congress at its last session provided the [illegible] to determine what portion of it may be reclaimed by irrigation.

And in Alaska the desirability of a better knowledge of our [illegible] and to the fear [illegible] boundary [illegible] limitation of the boundary can be made.

It is gratifying to note that the Bureaus of the Government are now devoted to the practical development of the economic resources of our great territory, have been conducted during the year with the energy that has marked their progress heretofore. But it is yet too early to place a value upon the special results of the year's work, and I will leave their consideration, therefore, to my successor.

I look upon the publications of the Topographical Surveys of the [illegible] Massachusetts as the most important cartographic productions in this country of recent years. Massachusetts has been the first State to avail herself of the full facilities offered by the General Government in preparing maps of their territories on working scales, although New Jersey was earlier in the field and obtained all the assistance that could be rendered by the laws in force at the time. The expense of the survey in Massachusetts has been borne about equally between [illegible]ate and United States, exclusive of the triangulation work, and the total cost to the State being so light, we may hope eventually to see similar, or even more detailed work, undertaken by all the States of the Union. The atlas sheets thus far produced are most pleasing specimens of the cartographer's art, each feature or class of detail having been given a weight that permits easy reading without producing undue prominence in any. In the atlas sheets of New Jersey, published by the State, the same admirable effects have been produced, but in a different style of treatment, the questions involved being more complicated through the introduction of greater detail. Massachusetts is also in the lead in promulgating a precise determination of town boundaries by a systematic reference of all corner marks to the stations of the triangulation that now covers the State territory. The expense of this work is borne by the State, with the exception of a small amount in salaries to United States officers detailed to execute portions of the work under existing laws. The total cost will probably approximate the total cost of the Topo[illegible] advantages to be derived from it will result in large savings to the people of the State.

Our neighbors in the Dominion of Canada have been active of late years in investigating their resources. The completion of the Canadian Pacific Railway [illegible] for [illegible]

[illegible] during the summer direct to Europe—but there seems to be reason [illegible] question of the practicability of such a route. During the past two seasons Canada has also been engaged upon extensive explorations in the Northwest territory, along the boundary line [illegible]. The results [illegible] last summer's labors, and it will probably be some time in the winter before we can supplement the chapter of a year ago from this interesting region.

But little advance has been made during late years in solving the mysteries of the Arctic. In the past summer a party has crossed the southern part of Greenland, but advices have not yet come to hand that would indicate the value of the exploration. A second party was organized to follow the east coast of Greenland to the northward, that we may hear from at a later date, although reports already received, if true, would indicate the effort had been baffled by adverse weather. A few months ago an expedition was seriously contemplated by Europeans to the frozen seas of the Antarctic. As it was to have been backed by [illegible] for its purposes, and we may, therefore, sincerely regret the rumor that the project has been postponed if not abandoned.

In the Central American States a Congress has been assembled to consider the unification of the States under one general government—a union, the practicality of which has long been discussed, but from the jealousy of rival factions has heretofore seemed impossible of accomplishment; but there is some hope that the labors of the Congress now in session will prove more successful.

The greatest interest in these States is centered in the projects for interoceanic canals. The scheme to cut the Isthmus of Panama undertaken by the eminent French engineer, De Lesseps, has been beset with many difficulties, not the least of them arising from the unprincipled management of those having [illegible] charge of the work. It is impossible to foresee the eventual outcome of the great work, as all reports expressing official views on the subject are tinged with a coloring from the personal opinions of the authors of them. The original plans have been modified to include locks for crossing "a summit level."

This is stated to be only a temporary expedient to secure the opening of the canal at an early date, and that eventually the [illegible]
It seems evident from the latest reports that work will be pro[illegible]
[illegible] as a probability of the canal becoming an accomplished fact. A [illegible] that has also been under discussion for many years, has recently been energetically advocated by American engineers, with the result of the actual location of a line and careful cross-sectioning during the past year. A company has been formed and obtained a charter from the State of Vermont, and as it is represented [illegible] have the gratification of seeing an interoceanic canal opened under American auspices.

Many speculations have been indulged in as to the probable effect of a canal through the Isthmus on the carrying trade of the world, the impetus it might give to the opening up of new commercial routes, and even the effect it may have in advancing our civilization to distant nations. Such speculations are hardly pertinent to this report, but we may well reflect upon the changes that have been wrought since the opening of the canal through the Isthmus of Suez, and conceive, if we can, the leveling up that may accrue to the political divisions of the western world [illegible] for Isthmus.

South America has been free from serious agitation until a recent date, although some of the States have not failed to show the usual internal dissensions in political affairs. Late advices intimate a possible difficulty between Venezuela and England relative to the control of a large territory embracing the mouth of the Orinoco River, which, should it result in the permanent occupation of the disputed territory by the European power, may wield a marked influence in the development of this section of the continent.

A project that has long been agitated, to construct a continental railway that would give direct rail communication with the northern continent, has recently been renewed, and we can but hope with an earnestness that will lead to its accomplishment.

Large areas [illegible] become [illegible] to us, for we expect to [illegible] knowledge [illegible] graphic work [illegible] relation of [illegible] become more assured.

The [illegible] of a [illegible] will [illegible] own in the interest it will stimulate in kindred societies over the world.

Geology is a science so intimately connected with Geography that I should feel delinquent did I not include a reference to [illegible] to the subject.

To Geographers the origin of the varied distribution of land and water, the cause and growth of mountains, plains, [illegible], and [illegible] forms, the great [illegible] of the face of the earth in times past, is of absorbing interest, created only by their desire for perfect knowledge of that which may be seen to-day. Had the prehistoric man been gifted with [illegible] and [illegible] have left for us a record that would have been valuable indeed and cleared our way of much that now is speculation, and but too often food for words. True it is, however, that if the mysteries of the past were revealed to us we should lose the pleasures their study affords and perhaps there would follow a degeneration of species through the loss of stimulus they now provide. How long ago man lived and might have made a record is still a disputed question, but one that involves not, the record of the earth herself. The association of human remains in the Glacial drift brings that epoch in the earth's history nearer to us by several hundred thousand years, and instead of speculating [illegible] we [illegible] must consider whether it was not probably coincident with the most recent [illegible] of the earth which astronomers teach us happened about ten or fifteen thousand years ago. Geology must also fit her facts to mathematical science if we give credence to [illegible] a [illegible] of about five [illegible] there is a belt of "no stream," the result of opposing forces above and below [illegible] from the nature of the case is [illegible] by the [illegible] which [illegible] above [illegible] below cannot pass to what is above [illegible]

would confine the origin of a numerical and volcanic disturbance [illegible] the crust.* The result of the computation is certainly interesting and we may hope will not be lost sight of in future discussions, however it may share in general support or opposition. It is based upon an assumption of the temperature when the earth began to cool, to assume a lower temperature draws the belt nearer to the surface and a higher temperature is believed to be inconsistent with our knowledge of what heat may effect. The belt is stated to be gradually sinking, however, and the computation, therefore, involves a term representing time, and I venture to suggest that [illegible] seem to be inexhaustible, an abundance can probably be supplied to sink the belt deep enough for all theoretical purposes.

More interesting to Geographers are the conceptions of ancient [illegible] a late number of Science (June 15, 1888), on "The Creative Hypothesis and Modern Science." In the full play, we may conceive that where we now have extensive mountain ranges, there were formerly great plains of sedimentation, and where we see the process of sedimentation active to-day there may be great mountains in the future. And also in his inquiry into the "Origin of the divisions between the layers of stratified rocks" (Proced. Boston Soc. Nat. Hist., vol. xxiii), we may be carried away with the ingenuity of the changes suggested. The recurring destruction of submarine life to contribute in the building of the rocks of the Continents, the apparently endless cycles of emergence of the land and inundations of the waters, to leave the Geographical conditions we see to-day, furnish additional evidence of the wonders of the past and force upon us anew the realization of how little in the great evolution is the epoch in which we live.

American Geologists have advanced the knowledge of the west [illegible] combined Salisbury to interpret the terminal moraines of Northern Germany (Am. Jour. Science, May, 1888), and that the Science [illegible] active among our counterparts is evidenced by the formation of a Geological Survey and the establishment of a magazine de-

* To the [illegible] placing the loss of earthquakes and other disturbances in the strata above the belt

voted exclusively to its interests. America, too, contributed largely to the Geological Congress recently held in London, and it is pleasing to note that the next session of the Congress is arranged for Philadelphia.

At the suggestion of one of our associates I call the attention [illegible] and interested in [illegible] geographers, to a recent publication on the "Physical Geology of the British Isles," by Jukes Browne (Scribner & Welford, N. Y.). It has been characterized as the best treatise on the evolution of the land areas which has yet appeared; from the geological point of view it is the book of the year. Another associate recommends as most attractive [illegible] articles on "Three Formations of the Middle Atlantic [illegible]" W. J. McGee (Am. Journal Science, Feb.–June, 1888 [illegible]) [illegible] the most original essays of recent years.

It also gives me great pleasure to bring to your attention an article on the "Physical Geography of New E[illegible] W. M. Davis, in a book on the "Butterflies of New Eng[illegible]" [illegible] Scudder. It is hardly necessary to recommend this publication to your perusal, as I doubt not, being from the pens of our Associates, it will excite a lively interest in those devoted to these [illegible].

In conclusion permit me to refer briefly to the "National Geographic Magazine," published by the Society, the first number of which has recently been placed before you. It is the desire of the Committee having charge of the publication to make it a journal of influence and usefulness. There is abundant material in the Society to furnish the substance, if those who have it at command will make legitimate use of their opportunities. It would be unfortunate if the text should be confined to the papers presented to the Society. It was not the intention of the Board of Managers that such should be the case, when the publication was determined upon. On the contrary, it was the expectation that there would be original communications from many sources—essays, reviews and notes on the various subjects of the five Departments in which the Society is organized, not necessarily from the members, but also from their friends interested in these divisions of the general subject. While this expectation has been realized in a measure, there is room for improvement, and it is hoped the future will show an increasing interest and more generous contributions.

December, 1888.

REPORT—GEOGRAPHY OF THE SEA

By George L. Ives.

In presenting to the National Geographic Society this first annual summary of work accomplished in the domain of the Geography of the Sea, I find it impossible satisfactorily to limit the range of subjects that may be assigned to it. The great ocean is so large a factor in the operations of Nature, that the attempt to describe one of its features speedily involves the consideration of others lying more or less in that shadowy region which may be examined with equal force by other sections of the Survey. It is to be understood, therefore, that the full swing account merely touches upon several of the characteristics of the oceanic waters, and is not in any sense an attempt to treat them all.

This being the first report to the Society it has been thought advisable to give a brief outline of the progress made in our knowledge of the sea since 1749, when Ellis reported depths of 650 and 801 fathoms off the northwest coast of Africa. Even at that time an apparatus was employed to lift water from different depths in order to ascertain its temperature. It does not appear that this achievement gave impetus to further efforts in this direction, for, except in the comparatively small depths and a few temperatures reported by Cook and Forster in their voyages around the world in 1772–75, and in 1774 by Phipps in the Arctic, at the close of the last century there was but little known of the physical conditions of the sea.

At the beginning of the present century, however, more activity was shown by several governments, and expeditions sent out by France, England and Russia, in various directions, began to lay the foundation of the science of Oceanography.

Exploration of little known regions was the main purpose of most of these expeditions, but attention was paid as well to the observation and investigation of tides and tides, so that new charts of soundings, temperatures of sea water at various depths, its salinity and specific gravity, the drift of currents, etc., form part of their records.

The first to give us a glimpse of the character of the bottom at great depths was Sir John Ross, the famous Arctic explorer

While working in Port la Jolie Inlet, Baffin Bay, in 1819, by means of a contrivance on a deep sea clam, he succeeded in detaching and bringing up portions of the bottom from depths as great as 1,000 fathoms. The fact that this soil contained living organisms was the first proof of life at depths where it was thought impossible for it to exist. The truth of this discovery, however, was not generally accepted, many eminent men of science on both sides of the Atlantic expressing for and against it, and the question was not finally settled until long afterward, in 1860, when, by the raising of a specimen hydrophyte-tube in the Mediterranean unimpeachable evidence of the existence of life at the greatest depths that sea was obtained. The science, however, remained in its infancy until about 1850, when Maury originated his system of gathering observations from all parts of the globe, and by his influence energy aroused the interest of the whole civilized world in the investigation of the physical phenomena of the sea.

Through Maury's efforts the United States Government secured an invitation for a maritime conference, which was held in Brussels in 1853 and attended by representatives of the governments of Belgium, Denmark, France, Great Britain, Netherlands, Norway, Portugal, Russia, Sweden and the United States. The main object of the conference, to devise a uniform system of meteorological observations and records, was accomplished. According to the agreement, ships' logs were to have columns for recording observations of the following: latitude, longitude, temperature of air, direction and velocity of currents, direction and force of wind, serenity of the sky, fog, rain, snow and hail, state of the sea, specific gravity and temperature of the water at the surface and at different depths. It was also proposed that deep sea soundings should be taken on all favorable occasions, and that the other phenomena, such as hurricanes, typhoons, tornadoes, waterspouts, whirlwinds, tides, ice, fogs, showers of dust, shooting stars, haze, rainbows, auroræ boreales, meteors, etc., should be carefully described, and that observations made when practicable

The practical results of this conference were great. The systematic and uniform collection of data by men of all nations in [illegible] the [illegible] of many [illegible] to the geography of the Sea.

An epoch in the progress of this science is marked by the appearance of Maury's Wind and Current Charts, the Physical Geography of the Sea, and his Sailing Directions, which contain the record of the first deep soundings taken by United States vessels; and to the United States, through Maury's efforts, belongs the honor of having inaugurated the first regular cruise for the purpose of sounding in great depths.

Under the instructions of Maury the U. S. brig Dolphin, commanded by Lieut. [illegible] Lynch, was detailed in 1851–3 to search for reported dangers in the Atlantic, and to sound regularly at intervals of 240 miles going and returning. The Dolphin was provided with Middleton Brooke's sounding apparatus and with it succeeded in obtaining specimens of the bottom from depths of 2,000 fathoms. About the same period the U. S. ships Albany, Plymouth, Congress, John Adams, Susquehanna, St. Louis and Saranac were also employed in various localities, and to the U. S. S. Portsmouth, in 1853, belongs the honor of having reported the first really deep-sea sounding obtained in the Pacific, 2,400 fathoms, in about 39° 40′ N., and 180° 29′ W.

The practicability of this work was thus fully demonstrated, and, although some of the earlier results, through defective apparatus and lack of experience, were not entirely trustworthy, its character and success will always be a tribute to American enterprise and ingenuity.

With the advent of the submarine telegraph the investigation of the depth and configuration of the ocean bed became of vital importance, and the work of sounding for that purpose was taken up with activity; one of the first voyages in the interest of these projects was that of the U. S. S. Arctic, under the command of Lieut. C. H. Berryman, in 1856, between St. Johns, Newfoundland, and Valentia, Ireland.

The civil war naturally put a stop to these operations by United States ships. The U. S. schooner Fenimore Cooper was about the last engaged in this work, sounding in 1858–59 in the Pacific to 3,400 fathoms, and also reporting a sounding of 800 fathoms only ½ of a mile west of Gaspar Rico Reef, in about 14° 41′ N. and 108° 58′ E.

The work so well begun by the Americans was quickly taken up by other governments, and we find from that time to the pres-

[illegible] and parts of the world. [illegible] and instruments have made the results more precise than was possible [illegible] and as the data accumulate, the bathymetric charts of the oceans are becoming more accurate. Not until this work is much further advanced, however, shall we be able to arrive at an estimate of the [illegible] above sea level.

Other important results of these expeditions have been the [illegible] considered doubtful, the discovery of new ones, and proof of the non-existence of others, which had been reported as dangers to navigation.

[illegible] stage by the inception of several great scientific expeditions, of which that of the Lightning, in 1868, to the Hebrides and Faroe Islands, under the superintendence of Professors Carpenter and Wyville Thompson, was the forerunner. This was followed by the three years' cruise of the Challenger (Br.) in 1873–76, the [illegible] the U. S. Fish Commission, and others of lesser importance, sent [illegible] individuals. All of these have contributed in an eminent degree to the progress of the science by giving us a better understanding of the physical and biological conditions of the sea at all depths. Special mention must be made of the splendid work that is being done continually by the expeditions sent out by the U. S. Fish Commission. This branch of the United States service, originally established for the investigation of the causes of the decrease in the supply of useful food fishes and of the various factors entering into that problem, in pursuance of these objects has been prosecuting a detailed inquiry, embracing deep-sea soundings and dredgings, observations of temperatures at different depths, [illegible] state of surface and under currents, etc.; in other words, making [illegible] have brought to light from the deep beds of the ocean an ex-

[illegible] Fish Commission steamer Albatross has covered a greater number of [illegible] miles than the F. C. S. Albatross. This steamer has explored fishing grounds on the east and west coasts of the continent, and since the beginning of last year has made a cruise from the North to the South Atlantic along the east coast of South America through Magellan Strait, and northward along the west coast to Panama and the Galapagos Islands, and thence to San Francisco and Alaska. The scenes of her latest operations have been the plateau between the Alaskan coast and Unalaska and the banks off San Diego, California.

A large share in the progressive state of the science of the Geography of the Sea must also be credited to the systematic collection of marine observations by the Hydrographic Offices and other institutions all over the world. This forms the stock from which, as I have already indicated, must be drawn, through intelligent reduction and deduction, a better knowledge of the intricate laws governing the various phenomena of the sea and [illegible]

OCEANIC CIRCULATION

The existence of currents in certain localities was known at a very early date, and navigators in their voyages to the new world soon discovered the Gulf Stream and other currents of the Atlantic. The first current charts were published more than two hundred years ago. Theories were soon advanced to explain the causes, one group of scientific men attributing the origin of currents to differences of level produced by an unequal distribution of atmospheric pressure over the oceans, another set connecting [illegible] phenomena with the cause of ocean currents, and still another finding in the rotation of the earth a sufficient reason for their existence. The polar origin of the cold deep water found [illegible] gave rise to a theory of a general oceanic circulation in a vertical and [illegible] plane, produced by differences of temperature and density. Recent theoretical investigations, however, seem to indicate that these causes alone are incapable of producing currents, and, to-day the theory that the winds are mainly responsible for all current motion is very largely predominant. Dr. James Croll was perhaps the first who recognized in the trade winds the cause of the westerly set in the Pacific, and Rear

nel soon after made the division of drift and stream currents. The objections which have appeared against the wind theory have been met with the reply that the present state of ocean movements is the result of the work done by the winds in [illegible] less thousands of years.

Current phenomena is briefly summarized as follows by one of the latest authorities on the subject:

1. The greater portion of the current movement of the ocean may be regarded as a drift, produced by the prevailing winds, which are modified in direction and force and the measures for the mean set and velocity of the current.

Another group of currents, and in fact a fraction of all currents, consists of compensating or supply streams, created by the necessity of replacing the drifted water in the windward portion of the drift region.

3. A third group results from drifts deflected by the configuration of the coasts, these when set and concentrated form current, quickly pass into compensating streams.

4. The deflecting force of the rotation of the earth is considered as of subordinate importance, but may have some influence in currents that are wholly or in part compensating or free.

Late investigations of the Gulf Stream by the U. S. Coast Survey give interesting facts in regard to that notable current.

A satisfactory explanation of the cause of the stream has not yet been found, but many believe, with Franklin, that the powerful trade drift entering the Gulf of Mexico through the broad channel between Yucatan and Cuba presses the water as a strong current through Florida Strait, where the stream is turned to the northward along the coast. Since 1850 American navy officers have added greatly to our knowledge of the characteristics of [illegible] chiefly within the last decade, during which notable investigations have been carried on by Commanders Bartlett and Sigsbee and Lieut. Pillsbury, U. S. N., under the direction of the U. S. Coast Survey, and by Lieutenant Commander Tanner, U. S. N., in the Fish Commission steamer Albatross.

Of special importance are the valuable and interesting results in regard to tidal action in the stream obtained by Lieut. Pillsbury, U. S. N., in the Coast Survey steamer Blake, from observations begun by him in 1885 at the narrowest part of Florida Straits, where Key Rocks and Key Sand and Carysfort [illegible]

...ance between Jupiter Inlet and Cuba, and between Jupiter and Cape San Antonio (Cuba), and off Cape Hatteras.

During the past year Lieut. Pillsbury attempted the field of operations in the passages between the islands entering the Caribbean Sea, and in order to study the Atlantic flow outside the limits of the trade-drift a start was to have been made from a point 7 miles to the northeast of Barbados; this, however, was unfortunately prevented by bad weather.

The deductions from the observations in Florida Strait showed very clearly a *daily* and a *monthly* variation in the velocity of the stream, the former having a range of 2½ knots, and producing a maximum at the average about 0ʰ 9ᵐ before and 8ʰ 37ᵐ after the moon's upper transit, and the monthly variation reaching its maximum about two days after the maximum declination of the moon. The variations in this respect were found greater on the western than on the eastern side of the strait, and the axis of the stream, or position of emergent surface flow, was located by Lieut. Pillsbury 1½ miles east of Bowey Rocks, and, farther north, about 17 miles east of Jupiter Light. The average surface current at this section was 3½ knots, the maximum 5½ knots, and the minimum 1½ knots per hour. The results also indicate that when the current is at its maximum the surface flow is faster than at any depth below it, but when at its minimum the velocity at a depth of 15 fathoms or even down to 65 fathoms is greater than at the surface, and that there is at times a current running south along the bottom in all parts of the stream except on the extreme eastern side.

The results of the investigations in 1887 and 1888 have not yet been published, but from information kindly furnished by the authorities of the Coast Survey, I am able to give a brief outline of the more prominent facts ascertained.

In the section between Rebecca Shoal and Cuba the daily variation in velocity was found as prominent as in Florida Strait, the mean time of eight maxima corresponding to 0ʰ 16ᵐ before, and that of three maxima to 6ʰ 25ᵐ after the moon's transit. The axis of the stream in this section was found near the center of the current prism, and the flow was easterly and inclined on either side toward the axis. The axis seemed to occupy a higher level than the parts of the stream [illegible] but the surface flow was [illegible] thrown out in Florida Strait on the west side of the axis were re-

reversed along the east coast of Florida, while of those thrown out east of the axis but a single one was heard from. As a rule it was found that the stronger the current the more constant the direction and the deeper the stratum. Remarkable fluctuations in the flow near the axis were noted, the velocity increasing or decreasing about one knot in ten or fifteen minutes, and then abruptly decreasing again. Lieutenant Pillsbury attributes this, however, to a serpentine movement of the maximum flow, which would sometimes strike the stations occupied by the Blake. The edge of the stream was found at about 30 miles south of Hetzel's Shoal light-house.

Between Mantanzas and Cape San Antonio the stream was found flowing about north, and the time of maximum velocity corresponded on the average to 10h before and to 2h 30m after the noon transit. The excessive variations were met with in Florida Strait, on the west side of the stream, and the maximum velocity of 6¼ knots was found about 5 miles off the 100 fathom line of Yucatan Bank. The eastern edge of the stream lies about 20 miles west of Cape San Antonio, and between this edge and the island, eddy currents exist. At the time the determinations at this section was first occupied, the declination of the moon was low and the set of the surface current north-easterly. At a high north declination of the moon the surface current was found south-easterly in direction, and east or south-east below the surface. The normal flow below the surface was in each case from the Gulf into the Caribbean Sea, and this makes it probable that the slight variation observed instead of the average heat of the stream. On Cape San Antonio Bank the currents are tidal, flood running northward and ebb southward. On the Yucatan Bank the currents were also tidal, but as the edge of the bank is approached the stronger flow of the Gulf Stream predominates. The monthly variation in velocity, which was found nearly defined at the first two stations occupied, appeared at this section to be obliterated by anomalies not existing at the former.

Off Cape Hatteras the Blake accomplished the remarkable feat of remaining at anchor in 1,862 fathoms, and that with a surface current of over 4 knots. Two stations were occupied, and similar variations in velocity were observed as at the other stations. The notable feature at this station was the discovery of tidal action beneath the Gulf Stream, the currents at 200 fathoms depth changing their direction very regularly, the average current flow

ing about N. N. E. ¼ E. for 7 hours and N. N. W. ¼ W. for a little over 5 hours.

The first section investigated in 1884 was in the equatorial drift between Tobago and Barbados, where seven stations were occupied. The axis of the stream was found west of the meridian, [illegible] towards the north. At none of the stations did the current set in the direction of the wind, although the trades were blowing at all times with a force of from 2 to 7. The daily variation was also here very pronounced, the average time of maximum flow occurring about 4ʰ 50ᵐ after the moon's transit. At 65 and 130 fathoms the [illegible] at one south-easterly. The velocity at 130 fathoms [illegible] greater at the surface than at 15 and 65 fathoms.

At all of the three stations between Grenada and Trinidad tidal action was observed, with deflections due to moon influences. The passage between Soufrière Bay, St. Vincent, appears to be in the line of the equatorial stream. At each of the five stations in this passage tidal action was pronounced, the currents setting in and out of the Caribbean Sea at some depth. The [illegible] after the moon's transit, and a minimum when the moon is on the [illegible]. The currents entering the Caribbean Sea through this passage are [illegible] fathoms deep, but there is probably an almost equal volume flowing out below that depth.

Between the Windward Islands the currents flow generally westward, but tidal action is everywhere apparent.

To the east of Desirade the currents at all observed depths have a northerly direction, fluctuating between about N. E. by E. to N. W. by N.

In the eastern part of the Anegada Passage the surface current flows into the Caribbean Sea in directions varying between S. S. W. and S. E., but the submarine current down to 330 fathoms flows in a direction lying between north and east.

In the more western part of the passage the currents are more [illegible] in the vicinity of the station occupied.

In the Mona Passage no regular currents were perceptible. Between Mona and Puerto Rico the currents observed set out of the Caribbean Sea [illegible] from about W. by N.

[illegible] be an inward flow on the western side of the passage, near Santa Lucea, [illegible] of the current was usually between N. E. and W. by W. But few observations could be taken on account of unfavorable weather.

In the Windward Passage, on the western side the currents from the surface down to 180 fathoms set in the directions lying in the S. E quadrant, and at 200 fathoms the direction changed to W by S. On the eastern side the surface current varied between E. N E. and E. S. E., with about ½ knot velocity. Variations in the direction similar in extent characterized also the subsurface currents in the middle and on the eastern side of the passage.

The average of the observations at these three stations gives but a small volume of water passing in either direction.

In the old Bahama Channel, at the station north of Cayo Romano (island off the north coast of Cuba) the currents at and near the surface set south of east; at 65 fathoms, however, the direction varies from about N. W. to E. The deeper current of great volume flowed continually to the north of west with a velocity of over 1½ knots at depths of 150 and 200 fathoms.

Outside in Bahama Channel [illegible] current flows about N. W. on the surface and down to 30 fathoms at [illegible] fathoms deep the [illegible] to [illegible] to the Westerly, and at 130 fathoms to a point more easterly than the set of the surface current. [illegible] station occurs about 12[h] after the moon's transit.

The observations [illegible] by Lieutenant Pillsbury furnish the most valuable [illegible] we have at present concerning the Gulf Stream, and it is hoped that further investigation and the analytical treatment of these observations will clearly develop the dynamic laws of [illegible] current theory of current phenomena in general.

Tidal Phenomena.

The causes for many of the inequalities in the tidal elements observed at different places have not yet been satisfactorily explained. The predominant are beyond doubt many years' extent conditions. While we are able to ascertain with tolerable accuracy from [illegible] observations, derived from observation, the times and heights of high [illegible] the problem to compute theoret

[illegible] tion remains still unsolved. According to Ferrel our present knowledge of tidal phenomena is comparable to that possessed 2,000 years ago by the science of astronomy.

Temperature of the Sea

The temperature of sea water had already been observed by [illegible] seas and for various depths. The diversity of instruments and of methods employed by the earlier observers, and the faulty [illegible] of these observations difficult or impossible. The most complete and valuable collection of these older observations up to 1849, with an account of the instruments and methods used by each observer, was published by Prestwich, in 1874, in the Philosophical Transactions, Vol. 165.

With the advent of the great scientific expeditions, which were supplied with modern and refined instruments, our knowledge of the thermal conditions of the sea has progressed immensely, and we are now able to construct charts of all the oceans, show- [illegible] in the Indian Ocean than in either the Atlantic or Pacific; the [illegible]

The temperature generally decreases more or less rapidly from [illegible] uniformly between 80° and 40° F. From that depth it decreases slowly towards the bottom—in the Polar seas to between 27° and 29° F., in the middle and higher latitudes of the northern hemisphere and at depths of 2,000 to 3,000 fathoms, to between 34° and 38° F.; at the equator and in southern latitudes it remains in the neighborhood of 32° F.

The low temperatures at the bottom are thought to be due to a steady but slow circulation of water from the Polar seas towards the equator, and, where the circulation is most free and unobstructed, as in the North Atlantic, South Pacific and Indian Ocean, the bottom temperature is slightly lower than in the North Atlantic and North Pacific, both of which are connected [illegible]

The theory of the circulation from the Polar seas is greatly strengthened by the facts arising from the investigations of the submarine isotherms in inclosed seas, i. e., seas which are separated from the deep oceans by submarine barriers. In such seas the temperature decreases evenly from the surface down to the depth of the barrier, and from there on remains constant to the bottom.

The influence of currents on the surface temperature is very marked, cold currents bending the isothermal lines towards the equator, and warm currents bending them towards the poles. The seasonal changes in surface temperatures are considerable, being the least in the tropical zones.

In the *Atlantic Ocean* the maximum surface temperature lies near the coast of South America, between Para and Cayenne, and another maximum occurs near the west coast of Africa, between Freetown and Cape Coast Castle.

The *Pacific Ocean* shows the peculiarity that the surface temperatures on the western side are lower than those on the eastern side. Between 45° N. and 45° S. the temperature does not fall below 60°, but between those parallels and the poles it remains most always below that figure.

The warmest water is found in the *Red Sea* where the surface temperature has been recorded as high as 93°. North of the [illegible] to about the parallel of 25°, it varies from 80° to

Chemical Composition, Salinity and Density of Sea Water.

In this branch of inquiry great progress has been made, and sea water is now known to contain at least 40 elementary bodies. Its chief constituents are found to consist of the chlorides and [illegible] contains air and carbonic acid.

The salinity and density of sea water have been investigated by [illegible]. As the salinity of the sea [illegible] of its density, changes in the former [illegible] natural [illegible] water. The salinity has been found generally to increase [illegible] the shore, where the rivers discharge the water into the sea, and [illegible] a maximum in the open sea, and a minimum in the equatorial zone. The salinity in

affected by the [illegible] of evaporation and by precipitation, rainfall, and is now recognized as an important factor in the biologic conditions of the sea.

Of the three great oceans, the Atlantic, with a salinity of 3.60 per cent., shows a slight preponderance over that of the Pacific and Indian Ocean, whose average salinity is 3.50 and 3.47, respectively.

In the trade belts the great evaporation augments the salinity and hence, also, the density, and in the polar zones the formation of ice brings about the same result, though in a lesser degree. In the equatorial calm region the frequent rainfall diminishes salinity and density through the duration of low salt water. Density and salinity are thus in a certain degree subject to annual changes.

In the Atlantic the density increases in general from the higher latitudes towards the equator, but the maxima are separated by a zone of lower density. The maximum in the North Atlantic ocean is found between the Azores, the Canaries and the Cape Verde Islands, and the minimum between the equator and 15° N.

In the South Atlantic two maxima occur, one to the north of Trinidad, and the other near St. Helena and between that island and Ascension.

Taking pure water at 4° C. for unity, the maximum density in the Atlantic is 1.0275 and in the Pacific, 1.0270.

In the *North Pacific* the maximum density occurs between 30° and 31° N., and the minimum is about 7½° N., in the equatorial counter current, where it was found as low as 1.0245.

In the *South Pacific*, which has a slightly greater density than the North Pacific, a maximum has been [illegible] of the Society Islands.

The density of the waters of the *Indian Ocean* is not yet as well known as that of the Atlantic and Pacific, but the results ascertained [illegible] a maximum in the region between 20° and 30° S. and long. 80° to 80° E.

In the vicinity of Java and Sumatra, probably on account of the extreme humidity of the atmosphere and of frequent rainfall the density has been found as low as 1.0250.

In regard to the density of the water at various depths it has been ascertained that as a general rule it decreases from the surface downward about 1,000 fathoms, after which it remains uniform

a wly to t[illegible]. In [illegible] where the heavy mass dilute the surface water, the density decreases from the surface down to between 50 and 100 fathoms, after which it follows the law found for other parts of the ocean. The bottom densities of the South Atlantic and Pacific have been found almost alike, varying only from 1.02570 to 1.02590; those of the North Atlantic, however, show a greater range, varying from [illegible] to 1.02644.

Greatest Depths of the Oceans.

Atlantic.—Rejecting some of the earliest soundings as untrustworthy, the greatest known depth in the North Atlantic is to the north of the island of Puerto Rico, in about latitude 19° 39' N., longitude 66° 26' W., found by the U. S. S. Nyanza, Lieut. Commander Brownson, U. S. N., in 1852 to 4,561 fathoms.

The deepest known spot in the South Atlantic is 3,984 fathoms, in about latitude 19°-65' S., longitude 24° 53' W., sounded by the U. S. S. Essex, Commander Bailey, in 1853.

The general run of the soundings indicates that greater depressions exist nearer the western than in the eastern or middle part of the Atlantic, North and South.

Pacific.—In the North Pacific the greatest depression has been found by the U. S. S. Tuscarora, Commander Geo. E. Belknap, U. S. N., in 1874, 4,655 fathoms, in latitude 44° 54' N., longitude 152° 28' E. The next deepest sounding in the North Pacific was located by the Challenger in 1875, 4,475 fathoms, in latitude 11° 24' N., longitude 142° 10' E. As in the Atlantic, the greater depths appear to exist in the western part and particularly off the coasts of Japan.

In the South Pacific the greatest depths were supposed, up to a recent period, to be in the eastern part. Within the last two years, however, the British surveying vessel Egeria has discovered greater depressions in the western part of the South Pacific, one spot sounding 4,430 fathoms in latitude 24° 37' S., longitude 175° 09' W., and another, 12 miles farther south, 4,298 fathoms.

Indian Ocean.—In this ocean the greatest depths appear to exist to the north and west of the Australian continent, where there are more than 3,000 fathoms in a number of widely separated spots, showing a deepest area [illegible]

In the most northerly part of the Indian Ocean [illegible]

Antarctic region, the Challenger obtained, in 1874, a maximum depth of 1,073 fathoms, in latitude 65° 42′ S., longitude 78° 40′ E.

Arctic Ocean.—The greatest depth was sounded by the Swedish Vega, 2,650 fathoms, in latitude 79° 6′ N., longitude 6° 30′ W.

In the minor seas the maximum depths so far as ascertained are

Caribbean Sea	4,452 fms., south of Great Cayman.
[illegible]	Sigsbee Deep.
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	

[illegible]

REPORT GEOGRAPHY OF THE AIR

BY A. W. GREELY

In presenting to the National Geographic Society a summary of meteorological phenomena as regards the domain of the air, I have found it a task somewhat difficult. The terror of passengers from the east to the west coast of America, and less often in navigators across that great continent, is press on his memory an almanac picture of the physical features of that country which he has passed, and of the general state of plant and animal life. But one, in a vessel sailing from one ocean to another, knows little about what he shall see, for his instruments do not give him quite a definite idea of the relief features of the bottom of the sea.

Small as are the forces with which we have to [illegible] the sun, heat, and [illegible] enable us to give a description of the air. Its phenomena, natural agencies are so great and their action is so rapid, that to [illegible] to draw the roughest figure of a passing storm. To note changes in the force and direction of the wind, to note the depth of the rain, the increase and decrease of temperature and the varying changes of aqueous vapor, either in sensible or invisible form, requires in lieu of careful, systematic observations, and then when these are made, the task of collating and discussing them seems almost too great for any man. Eventually the value of meteorological work can be impressed not on the only upon governments which have assisted it liberally by appropriations and organization, but yet more upon the humblest observer, the thousands of whom over the face of the earth give of their time and labor, and add their mite to the world of [illegible] knowledge.

In connection with all great physical questions, there is at times a tendency to lay undue stress on special phases somewhat to the neglect of others. While it can hardly be said that scientific and theoretical discussion of meteorology has been unduly neglected during the past years, yet it is evident that the greatest activity of meteorologists has been devoted to climatological investigations, and computations of this character have been par-

nearly numerous during the past year—not in the United States and Europe alone, but throughout the whole world.

The growing practical importance of meteorological researches has been lately evidenced perhaps in no more striking way than in the establishment at Brazil of a most extensive meteorological service, created by a decree of the Imperial government on April 4, 1888. A central meteorological institute, under the Minister of Marine, is to be the centre for meteorological, magnetic and other physical researches, and observations are to be made at all marine and military establishments in the various provinces, on the upper Amazon, in Uruguay, and on all subsidized government steamers. This service should soon be fruitful in results, as the meteorology of the interior of Brazil is almost absolutely unknown.

Another vast scheme has originated in Brazil in the Imperial Observatory of Rio Janeiro. Señor Orville, its director, contemplates a dictionary of the climatology of the earth, giving monthly means and extremes of pressure, temperature, rainfall, wind, etc. This scheme, of course, can be successfully only by international co-operation. The United States Signal Service has pledged us and as regards this country.

The former tendency among Russian meteorologists to devote their greatest energies to climatological compilations has gradually given way to more practical work in connection with weather and storm predictions, as shown by the establishment by the Russian government of a system of storm warnings for the benefit of vessels navigating the Black Sea.

Hanford has put forth an important paper, which partially elucidates the very intricate question of diurnal barometric changes, particularly bearing on the relation of the diurnal pressure to [illegible] cycle of temperature, cloudiness and rainfall. The question is viewed in a negative sort by Lamont, as to whether the maximum barometric pressure could be attributed to the greatest rate of increase in the temperature of the air, due, it is supposed, to the retardatory effect of the heated and expanding air, has been re-examined by Hanford, whose conclusions are somewhat in favor of this theory.

S. A. Hill has treated of the annual variation of pressure, so potent in India, and in so doing has investigated the changes of pressure for three levels, up to a height of 4600 meters. The reduction of monthly barometric means at high levels, hav-

ing regard to the vertical distribution of temperature, shows a double oscillation in the annual curve at the level of Leh, which becomes a single one at the height of 4500 meters, when it is undoubtedly the reverse of the oscillation observed below.

The subject is also treated in similar way by Mr Hill, through the use of normal isobaric means for all India, whereby he succeeds in presenting a formula, the first periodic terms of which represent the two principal factors of the oscillation.

Mr. Hill has also discussed concurrently the anomalies in the winds of India and in their relation to the diurnal wave of barometric pressure. The anomalies are—(1) as the last season the wind direction frequently shows no relation to the barometric gradient, (2) the winds over the plains show little or no relation to pressure gradients, but do obviously owe to temperature, being greatest where the temperature is highest.

It is pointed out as highly probable that the copious rainfalls of the rainy season in the northwest Himalayas not only produce low temperatures on the Himalayan ranges, but subsequently cause dry northwesterly winds over northern and western India, and on this supposition, rainfall forecasts of the character of the coming rainy seasons have been made for a number of years.

Convection currents between upper and lower air strata, it is suggested by Köppen, explain diurnal variations in wind velocity and direction. At low stations the maximum velocity occurs at the time of the highest temperature, while at high stations the reverse obtains. Hill has examined into an important point connected with this subject, that is, the great local differences in the vertical variation of temperature. Hill concludes by saying that high pressures at low levels are the result of low temperatures, and in connection with the fact that wind directions are largely [illegible] it is more important to know the abnormal variations of pressure at the highest rain stations in India than those in the plains.

Overbeck has lately published a paper on the apparent motions of the atmosphere, in which he clearly and admirably outlines the treatment of the dynamics of the air by his predecessors. He comments on the mode of treatment of Ferrel, as well as those of Guldberg and Mohn. Overbeck then sets forth his own method, and elaborately discusses the influence of the earth's rotation with reference to [illegible] of the air [illegible]. He [illegible] rapidly [illegible]

find entirely fund at rest, the development of discontinuants revealed by Hermanitz currents, the two sets of parallel currents of unequal velocity as towards similar velocities, the effect of friction arising from meet ing currents of different velocities, upon the coefficient of friction, of the temperature distribution over the surface of the earth, etc. He derives three very simple expressions for the motions of the air; the first giving the velocity in a vertical direction at any point, in terms of latitude, and a coefficient and factor depending on the distance of the point above the surface of the earth. The other expressions give the velocities in north or south direction, and in east or west direction, also in terms of constants and latitude. The velocity when charted from Overbeck's equations indicates an ascending vertical current from the equator to 35° north, and thence a descending current to the pole. The actual ocean currents at the equator and the poles are zero, and have a maximum value at latitude 45°.

Clayton's paper, from most important investigation of thunderstorms, shows that these phenomena invariably attend motionless areas of low pressure, and he says the surest elements for predicting such storms will be found to be the pecularities in distribution of temperature and absolute humidity. He observes that the storm front invariably tends to project itself into the region where the humidity is greatest, and that all dull and oppressively rapidly moving storms of deep barometric depression bring in their train the full complement of conditions known to be favorable to the production of high temperature and high humidity. Between the tropics that seem to be important elements are the cause of thunderstorms, and hence they are most frequent when the temperature distribution with altitude is very great, so that the overheating of the lower air strata in the warmest part of the day is the cause of the primary maximum of thunderstorm frequency.

Ahlenius and H. Johannsson have renewed their recommendations for a re-issue of charts in ten fundamental types, in which the first part of the compound name, such as cyclonic, anti-cyclonic, etc., is to be in a measure indicative of the height of a cloud.

Dr. Shrubsole has charted the differences of monthly means of air pressure for January, 1874 to 1884. In January, 1874, the values at nearly all the stations in the Northern Hemisphere were plus and those in the Southern, minus. It is to be hoped that such general discussions of this important meteorological element may be continued.

General A. Von Tillo has determined, by means of the planimeter, the distribution of temperature and pressure from Teisserenc de Bort's charts. The mean pressure over the Northern Hemisphere for January, he finds to be 29.90 inches (759.7 millimeters), and the temperature 46° 9 (8.8 C.); in July, 29.84 (758.5 mm.) and 72° 7 (22°.6 C.). In Russia he finds an increase of one millimeter of pressure to correspond with a decrease of 1°.6 C. in temperature.

Doberck after investigation of September typhoons at Hong Kong, attributes their appearance to the relatively low pressure then existing between Formosa and Lyeu.

The valuable and elaborate investigation of American Storms, by Professor Elias Loomis has been completed. Loomis has thoroughly discussed barometric maxima and minima areas as presented by the maps of the Signal Service, from which it appears that these areas are in general elliptical, with the longest axis nearly twice that of the shortest in the high areas, while the difference is less in low areas. He has also investigated the winds relative to barometric gradients, thus affording valuable data for proving various meteorological theories. Loomis' researches regarding the movement of maximum areas verify those which have been set forth from time to time in Signal Service publications; wherefrom it appears that high areas have a more southerly movement than low areas.

Van Bezold has put forth a memoir on thermodynamics, while Helmholtz, Oberbeck, and Dines-Hann have contributed valuable memoirs on motions caused by gravitation and the varying density of the air. These furnish meteorologists with important results as to the laws of fluid or gaseous motions. It is gratifying to Americans to note that the valuable results obtained by Ferrel in his many memoirs are confirmed by these later investigations.

Undoubtedly the most important meteorological event within the past year was the adoption, on January 1, 1884, of the system of International Simultaneous Meteorological reports inaugurated in accordance with the agreement of the conference at Vienna in September, 1873. As the charts of storm tracks, based on these observations, have been published by the United States Signal Service one year before the date of the observations, the completion of this work in printed form for the general public should occur about December 31, 1885.

A few remarks in connection with this unparalleled set of observations may not be out of place. The congress which agreed upon this work, met in accordance with invitations issued by the Austrian Government in September, 1873. The co-operation decided upon at this congress took practical shape January 1, 1874, on which date one daily simultaneous report was contributed from the Russian and Turkish Empires, the British Islands, and the United States the energetic co-operation of these nations being assured through Professor H. Wild for Russia; Professor A. Coumbary for Turkey; Mr Robert H. Scott for Great Britain; and Bvt. Brig. General A. J. Meyer, for the United States. Concurrent action followed shortly after on the part of Austria, through Professor Carl Jelinek; Belgium through Professor E. Quetelet; Denmark through Capt. Hoffmeyer; France through Messieurs U. J. Leverrier, Marie Davy, and St. Claire Deville; Algeria by General Parre; Italy by Professor Giovanni Cantoni; the Netherlands by Professor Buys Ballot; Norway by Professor H. Mohn; Spain by Professor A. Aguilar, Portugal by Professor F. de Silveira; Switzerland by Professor E. Plantamour; and the Dominion of Canada by Professor C. T. Kingston. Within a year the average number of daily simultaneous observations rose within the limits of the United States increased to 214. Later, the co-operation of the Governments of India, Mexico, Australia, Japan, Brazil, Cape Colony, Germany, and Greece, was obtained, and also of many private observatories at widely separated points throughout the Northern Hemisphere.

In the sixteen years during which simultaneous meteorological observations were continued, reports were received from nearly fifteen hundred different stations, about one-half being from land stations, and the others from vessels of the navies and the merchant marine of the various countries.

The total number of storm centers, counting one for each 5-degree square over which the centre has been traced from the International Simultaneous observations of 1878 to 1887, inclusive, aggregates over forty-two thousand, an annual average of over four thousand two hundred. Less than $\frac{1}{10}$ of 1 per cent. of these storms occurred south of the parallel of 10°, and only $\frac{1}{4}$ of 1 per cent. south of the parallel of 15°. In marked contradistinction to this freedom of the equatorial regions from storms there is to be noted the excessive prevalence of these phenomena between the parallels of 40° and 60°, north, in which

regions substantially two-thirds of the storms of the Northern Hemisphere occurred; while between the parallels of 45° and 55°, north, 30 per cent. of the entire disturbances are recorded. The most remarkable belt of storm frequency on the Northern Hemisphere is that extending from the Gulf of Saint Lawrence westward to the extreme end of Lake Superior, as nearly 8 per cent. of all the storms of the Northern Hemisphere passed over this limited region; the maximum frequency (1.4 per centum) occurring over the 5-degree square northeast and of Lake Huron.

In regards to [illegible] distribution, an unusually large proportion of storms prevailed between the 60th meridian and 100th meridian, west; 47 per cent. or one-third of all the storms of the Northern Hemisphere occurring within this region. A [illegible] of comparative storm frequency extends from the meridian of Greenwich eastward to the 30th meridian; over which region 15 per cent. of the entire number of storms occurred.

Only four hundred, or less than 9 per cent. of the entire number of storms, entered the American continent from the Pacific ocean, while about thirteen hundred storms, exclusive the West India hurricanes, passed outward off of the American continent. Over nine hundred storms entered Europe from the Atlantic ocean, of which probably four hundred and fifty, or ten per cent. of the whole number recorded, were developed over the American ocean. Probably not thirty storms, or less than three per cent. of those which entered Europe from the Atlantic, crossed the entire continents of Europe and Asia to the Pacific ocean. Fully two-thirds of the storms which enter Europe from the Atlantic are designated as active storm-centres before they reach the Asiatic frontier.

[illegible] of great bodies of water which surround it will [illegible] by land to penetrate storms or fair weather developments, is evident from the annual prevalence of storms over the great lakes, the St. Lawrence bay and the Gulf of Mexico in North America; over the North and Baltic seas, Bay of Fundy and the Mediterranean in Europe; the Bay of Bengal and over the China and Japanese seas.

Undoubtedly a considerable proportion of these storms are drawn towards these regions owing to the effect of evaporation upon the warm day and temperature of the superincumbent atmosphere, so that a very considerable proportion of the storms entered in these squares have not originated therein, but have been drawn up from

neighborhood of the Bermudas. Those entering in March, in North America, as storms pass over the lake region and St. Lawrence valley, whether they have originated in the Gulf of Mexico, on the Pacific slope of the Rocky mountains in the United States, or further north in the Saskatchewan country. In September storms pass southeastward from the Atlantic ocean to the Azores, and northeastward from the Atlantic ocean to the west, and then later show a very marked tendency to pass over the Black and Caspian seas.

The tendency of storms originating in diverse areas to move toward the same regions in the United States, is very evident from the normal storm track charts for April, May, June, August, November and December.

The operation that gales rarely, if ever, occur upon the equator is confirmed by these storm tracks. The most southern storm in the North Pacific ocean, between Japan and Jap, 1880, between the Island of Borneo and Mindanao, an excellent account of which is given by Fred Mark Dechevrens, S. J., in the Bulletin Mensuels of Zi-ka-Wei Observatory. The most southern storm over the North Atlantic ocean, in November, 1878, was remarkable for its extent, duration, length of its path, and the enormous destruction of life and property. It was central on the [illegible] a violent tropical hurricane near Trinidad, the barometer being 29.08, the lowest ever recorded there, and, from its intensity and velocity, it is more than probable that it originated considerably to the eastward, and possibly somewhat to the southward of that island. The storm was described in the U. S. Monthly Weather Review for September, 1878.

The writer looks with considerable interest to the result when may follow from a discussion of the annual fluctuations of the atmospheric pressure as shown by the monthly pressures reduced from the ten years' international observations. As far as these means have been examined they show that the period of atmospheric pressure is largely in accord with the results set forth in 1883 in The Report of the Early Frank Bay Expedition. The conclusions expressed in that year were that, at no distant day, the general laws of atmospheric changes will be formulated, and that later, from abnormal barometric departures in remote regions may be predicted the general character of seasons in countries favorably located.

The success of long-time predictions of this class for India, has been set forth in a previous part of this report. It is believed

that a further discussion of meteorological phenomena on a broad basis, by means of International Weather Charts, both in daily and monthly form, must eventually result in important and fundamental discoveries. It is gratifying to American pride to know that in this international task of studying the geography of the air, the United States has liberally provided the labor and means for presenting these ten years' meteorological data in such tabular and geographical forms as to render them available for study by all.

Acknowledgment is due to Professor Thomas Russell, for valuable translations, especially from the German; which translations have been of material value in preparing this report.

December 1888.

REPORT—GEOGRAPHY OF LIFE.

C. HART MERRIAM.

During the year now drawing to a close not a single work which I conceive to fall legitimately within the scope of the department of Geography of Life has appeared in any part of the world, so far as I am aware. It being manifestly impossible, then, to comply with the requirement of the By-laws calling for a summary of the work of the year, I may be pardoned for digressing sufficiently to speak of what seems to be the *function* of this Society in its relation to biology.

The term '*Geography of Life*,' applied without limitation or qualification to one of the five departments of the Society is not only comprehensive, but is susceptible of different if not diverse interpretations. Indeed, without great violence it might be construed to comprehend nearly the whole domain of systematic botany, zoology, and anthropology. As a matter of fact, I believe it was intended to include everything relating directly to the distribution of life on the earth. Thus it would naturally embrace all sources of information which assign localities to species. Local lists and faunal publications of every kind would fall under this head, and also the narratives of travelers who meet on the animals and plants encountered in their journeys. In the single branch of ornithology, about fifty per cent. of the current literature would have to be included. The most obvious objection to this comprehensiveness of scope is the circumstance that a large [illegible] the National Geographic Magazine.

Hence it may not be amiss to attempt a preliminary reconnoissance which [illegible] defined as "a Survey of Class II, for Jurisdictional purposes." Let us seek therefore to run a boundary line about the territory we may fairly claim and cultivate. [illegible]

Before doing this it becomes necessary to bear in mind certain facts [illegible] the [illegible]. For example, that certain forms are restricted to forest regions, even in the same latitude, that some forms are almost world wide in distribution; that others are restricted to

very limited areas; that the ranges of very dissimilar [illegible] often geographically coincident, and that, as a rule, animals inhabiting contiguous areas are more nearly related than those occupying remote areas. The recognition of these facts early led to the attempt to divide the surface of the earth, according to its animal life, into "faunal" districts. By the term *fauna* is meant the sum of the animal life of a region.

A comparatively meagre supply of information is sufficient to indicate the principal faunal subdivisions of a country, but for mapping the exact boundaries of such areas a vastly greater and more precise fund of knowledge is necessary. The way in which such maps are prepared is by collecting all available authentic records of localities where the particular species in question is found. This is done by compiling published records, by examining museum specimens in various museums and private collections, and by work in the field. The data thus brought together are arranged on cards under authority and regions, as far as practical under species. The localities are then indicated by colored spots on an outline map, the space surrounded by the spots being washed in with a pale tint of the same color. A separate map is devoted to each species.

Faunal maps are made by combining a large number of species maps. In such combinations it is found, as a rule, that a considerable percentage of the species maps fall into certain well defined categories whose color patches are essentially coincident. The composite map thus formed by the combination of these maps may be held to represent the natural faunal areas of a country. Several such areas may be characterized by the common possession of several but [illegible] species, and may be combined to constitute a faunal province, several provinces a realm, and several regions a realm or primary zoogeographic division of the earth's surface.

Having ascertained the actual extent and limitations of the natural faunal areas, it remains to correlate the facts of distribution with the facts of physiography.

My own convictions are that the work of the botanist in [illegible] graphic Distribution should be restricted to the general causes of results that we should deal with physiographic deduction rather than with detailed observations and the tedious steps and laborious methods by which they are made available. Our aim should be to correlate the distribution of animals and plants with the

[illegible] formulate the laws which are operative in bringing about the results we see. In other words, we are to study cause and effect in the relations of physiography to biology.

The kind of work meriting discussion in the annual report of the Vice-president of this section are such philosophic treatises as those of Humboldt, Dana, Agassiz, DeCandolle, Engler, Darwin, [illegible] and Gilman. As it is unlikely that more than one or two such works [illegible] for profitable discussion.

January, 1896.

ANNUAL REPORT OF THE TREASURER

FOR THE YEAR ENDING DEC. 27, 1894.

THE TREASURER, in account with the NATIONAL GEOGRAPHIC SOCIETY

1894.

Dec. 27	To cash received from life members			$100 00
"	" " for annual dues year 1895			1 00 00
				$1,100 00
1894.				
Apr. 6,	By Cash—M. F. Peake & Co. (2 checks			$ 60 00
"	" Final dividend University fund of 1892			20 00
Oct. 11	" Paid Telegraph, Messenger & Tuppen, for printing and binding vol. I of Magazine	$ 16 50		
"	" Norris Peters, for photogravure plates for Magazine	58 00		
"	" Sundry expenses of Secretary	6 35	254 85	
Dec. 27	" Final Cash & Int. rent of fund			5 00
"	" " for incidental expenses			
"	" Treasurer	74 30		
"	" Stationery	98 35		
"	" Postage			
	Balance in hands of Treasurer as shown by the ledger			

To the National Geographic Society

The undersigned, having been appointed an Auditing Committee to examine the accounts of the Treasurer for 1894, have the honor to make the following report:

We have compared the receipts with the official list of members and find complete agreement. We have compared the disbursements with the vouchers for the same and find them to have been duly authorized and correctly recorded. We have examined the bank accounts and compared the checks accompanying the same. We have compared the balance in the hands of the Treasurer as shown by the ledger ($[illegible] with the balance as shown by the bank book ($944.7[illegible]) and found them [illegible] the difference being explained by the fact that a check for $18 drawn in favor of the Secretary of the Cosmos Club has not yet been presented for payment. We find the conditions of the accounts entirely satisfactory.

Very respectfully

A. H. KAUFMANN

A. K. GILBERT

ANNUAL REPORT OF THE SECRETARIES

The first step toward the organization of the National Geographic Society was the circulation of the following invitation on Jan. 20, 1888.

"Dear Sir: You are invited to be present at a meeting to be held in the Assembly Room of the Cosmos Club, Friday evening, January [illegible] at 8 o'clock for the purpose of [illegible] and [illegible] for the promotion and diffusion of geographical knowledge.

Very respectfully yours,

GARDINER G. HUBBARD, HENRY MITCHELL,
A. W. GREELY, HENRY GANNETT,
J. K. BARTLETT, A. H. THOMPSON,
and others."

In response to this invitation 33 gentlemen met at the appointed place and time. The meeting was called to order by Prof. A. H. Thompson, who stated its objects and nominated Capt. C. E. Dutton as chairman. The formation of a geographic society was discussed by Messrs. Hubbard, Bartlett, Thompson, Mitchell, Keenan, Gannett, Merriam and Gore.

The following resolution, introduced by Prof. Thompson, was adopted:

Resolved, 1. As the sense of this meeting that it is both advisable and practicable to organize at the present time a geographic society in Washington.

2. That this society should be organized on as broad and liberal a basis as regard to qualifications for membership as is consistent with its own well being and the dignity of the science it represents.

3. That a committee of nine be appointed by the chairman to prepare a draft of a constitution and plan of organization, to be presented at an adjourned meeting to be held in Lincoln Hall on Friday evening, January [illegible].

A committee was appointed by the chair consisting of Messrs. Hubbard, Greely, Bartlett, Mitchell, Keenan, Thompson, Gore, Pilsbury and Merriam for formulating a plan of organization.

A subsequent meeting was held on January 23, at which it was decided to incorporate the society, and the same committee was continued to carry out that purpose. On January 27 the society was incorporated, the following gentlemen signing the certificate of incorporation.

GARDISER G. HUBBARD,
C. E. DUTTON,
O. H. TITTMANN,
J. HOWARD GORE,
C. HART MERRIAM,
J. R. BARTLETT,
ROLPHS BERGEN, JR.,
J. W. POWELL,
HENRY GANNETT,
A. H. THOMPSON,
A. W. GREELY,
HENRY MITCHELL,
GEORGE KENNAN,
MARCUS BAKER
GILBERT THOMPSON,

and upon the same day the first meeting of the society was held in the Assembly hall of the Cosmos club, when it was organized by the election of the following list of officers and the adoption of the by-laws:

President,

GARDISER G. HUBBARD,

Vice-presidents

HERBERT G. GORE, A. W. GREELY,
J. R. BARTLETT, C. HART MERRIAM.
A. H. THOMPSON

Treasurer

CHARLES J. BELL

Recording Secretary

HENRY GANNETT,

Corresponding Secretary

GEORGE KENNAN,

Managers

CLEVELAND ABBE, W. D. JOHNSTON,
MARCUS BAKER, HENRY MITCHELL,
ROLPHS BERGEN, JR., W. H. POWELL,
G. BROWN GOODE, JAMES C. WELLING.

The number of members with which the society at its organization was 168. Since that date 45 have been elected to membership.

[illegible] Mr James Stevenson.

The present number of members is 209

The society has held 14 meetings, 13 of which have been [illegible] number of a magazine, copies of which have been distributed [illegible] of exchange.

[illegible] made.

Very respectfully submitted,

HENRY GANNETT,

[illegible]

Secretary.

Washington, D. C., December 28, 1888

[illegible]

[illegible]

This is to certify that we whose names are hereunto subscribed [illegible] of the United States, and a majority of whom are citizens of the District of Columbia, have associated ourselves together pursuant to the provisions of the Revised Statutes of the United States relating to the District of Columbia, and of an act of Congress entitled, "An Act to amend the Revised Statutes of the United States relating to the District of Columbia and for other purposes," approved April 23, 1884, as a Society and body corporate, to be known by the corporate name of the National Geographic Society, and to continue for the term of one hundred years.

The particular objects and business of this Society are to increase and diffuse geographic knowledge, to publish [illegible] transactions of the Society, to publish a geographic magazine, and other works relating to the science of geography, to dispose of such publications by sale or otherwise, and to acquire a library, and for the [illegible] rules and regulations to be established in its By Laws.

The affairs, funds and property of the corporation shall be [illegible] the general charge of Managers, whose number for the first year shall be seventeen, to consist of a President, five Vice Presidents, a Recording Secretary, a Corresponding Secretary, a Treasurer and eight other members, styled Managers, all of whom shall be chosen by ballot at the annual meeting. The duties of said officers and of other officers and standing committees, and their terms and the manner of their election or appointment shall be prescribed for in the By Laws.

Gardiner G. Hubbard,	J. W. Powell,
A. E. Dayton,	Henry Gannett,
O. H. Tittmann,	A. H. Thompson,
J. Howard Gore,	A. W. Greely,
C. Hart Merriam,	Henry Mitchell,
J. R. Bartlett,	George Kennan,
Hoggson Bernie, Jr.,	Marcus Baker.

[illegible]

OFFICERS.

1888.

President.

GARDINER G. HUBBARD.

Vice-Presidents.

HERBERT G. INGERSOLL
GEO. L. DYER
A. W. GREELY
C. HART MERRIAM
A. H. THOMPSON.

Treasurer.

CHARLES J. BELL.

Secretaries.

HENRY GANNETT. GEORGE KENNAN

Managers.

CLEVELAND ABBE. C. A. KENASTON.
MARCUS BAKER. W. H. POWELL.
ROGERS BIRNIE, Jr. O. H. TITTMANN
J. BROWN GOODE. JAMES C. WELLING.

BY-LAWS.

ARTICLE I

NAME

The name of this Society is the "National Geographic Society."

ARTICLE II.

OBJECT

The object of this Society is the increase and diffusion of geographic knowledge.

ARTICLE III

MEMBERSHIP

The members of this Society shall be persons who are interested in geographic science. There may be three classes of members, active, corresponding and honorary.

Active members only shall be members of the corporation shall be entitled to vote and may hold office.

Persons residing at a distance from the District of Columbia may become corresponding members of the Society. They may attend its meetings, take part in its proceedings and contribute to its publications.

Persons who have attained eminence by the promotion of geographic science may become honorary members.

Corresponding members may be transferred to active membership, and, conversely, active members may be transferred to corresponding membership by the Board of Managers.

The election of members shall be entrusted to the Board of Managers. Nominations for membership shall be signed by three active members of the Society, shall state the name and residence of the candidate and shall be presented to the Recording Secretary. No nomination shall receive action by the Board of Managers until it has been before it at least two weeks, and no candidate shall be elected unless he receives at least three affirmative votes.

ARTICLE IV

OFFICERS

The Officers of the Society shall be a President, five Vice-Presidents, a Treasurer, a Recording Secretary and a Corresponding Secretary.

The above mentioned officers, together with eight other members of the Society, known as Managers, shall constitute a Board of Managers. Officers and Managers shall be elected annually by ballot at a meeting

of the votes cast being necessary to an election. Lists of all holding annual tickets shall be given to each member who shall have power to fill any casual vacancy occurring during the year.

The President or in his absence, one of the Vice-Presidents, shall preside at meetings of the Society and of the Board of Managers; he shall together with the Secretary, sign all written contracts and all documents of the Society, and affix the corporate seal; he shall deliver an annual address to the Society.

Each Vice-President shall represent in the Society and in the Board of Managers a department of geographic science, as follows:

Geography of the Land
Geography of the Sea
Geography of the Air
Geography of Life.
Geographic Art

The Vice-Presidents shall foster their respective departments within the Society; they shall present annually to the Society summaries of the work done throughout the world in their several departments.

They shall be elected to their respective departments by the Society.

The Vice-Presidents, together with the two Secretaries, shall constitute a committee of the Board of Managers on Correspondents and Publications.

The Treasurer shall have charge of the funds of the Society, shall collect the dues, and shall disburse under the direction of the Board of Managers; he shall make an annual report; and his accounts shall be audited annually by a committee of the Society and at such other times as the Board of Managers may direct.

The Secretaries shall record the proceedings of the Society and of the Board of Managers; shall conduct the correspondence of the Society; and shall make an annual report.

The Board of Managers shall transact all the business of the Society, except such as may be presented at the annual meeting. It shall formulate rules for the regulation of its business. Nine members of the Board of Managers shall constitute a quorum.

ARTICLE V

Dues.

The annual dues of active members shall be five dollars, payable during the month of January, or in the case of new members, within thirty days after election.

The dues of members elected in November and December shall be credited to the succeeding year.

Associate members shall be exempt from annual dues, on account of the payment of fifty dollars.

No member in arrears shall vote at the annual meeting, and the names of members over three years in arrears shall be dropped from the roll of membership.

ARTICLE VI

MEETINGS

Regular meetings of the Society shall be held on alternate Fridays, from November until May, and excepting the annual meeting they shall be devoted to communications. The Board of Managers shall, however, have power to postpone or omit meetings, when deemed desirable. Special meetings may be called by the President.

The annual meeting for the election of officers shall be the last regular meeting in December.

The meeting preceding the annual meeting shall be devoted to the President's annual address.

The reports of the retiring Vice-Presidents shall be presented in January.

[illegible] active members.

ARTICLE VII

AMENDMENTS

These by-laws may be amended by a two-thirds vote of the members present at [illegible] meeting, provided that notice of the proposed amendment has been given at a meeting at a regular meeting at least four weeks previously.

MEMBERS OF THE SOCIETY.

a, original members.
l, life members.
* Deceased.
In cases where no city is given in the address, Washington, D. C., is to be understood.

ABBE, PROF. CLEVELAND, *a*. *l*.,
Army Signal Office. 2017 I Street.

ABBOT, S. T. (Sylvanus Thayer),
810 Nineteenth Street.

AHERN, JEREMIAH,
Geological Survey. 804 10th Street.

ALLEN, DR. J. A. (Joseph Assph),
American Museum Natural History, New York.

APLIN, S. A., JR. (Stephen Arnold),
Geological Survey. 1816 R. Street.

ARRICK, CLIFFORD, *a*.,
Geological Survey. 1101 Fourteenth Street.

ASHBURNER, PROF. CHARLES A.,
Pa. Geol. Survey, Hamilton Bldg., Pittsburg, Pa.

ATKINSON, MISS E. S. (Emma Seccombe), *a*.,
Washington Normal School. 918 Massachusetts Avenue.

ATKINSON, W. R. (William Brassum), *a*.,
Geological Survey. 2990 Q Street.

AYRES, MISS S. C. (Susan Caroline), *a*.,
Pension Office. 602 A Street SE.

BAKER, PROF. FRANK, *a*.,
Light House Board. 1315 Corcoran Street.

BAKER, MARCUS, *a*.,
Geological Survey. 1125 Seventeenth Street.

BALDWIN, H. L. (Harry Lewis), *a*.,
Geological Survey. 125 Sixth Street NE.

BARNARD, E. C. (Edward Chester), *a*.,
Geological Survey. 1718 G Street.

BARTLE, R. F. (Rudolph Francis),
447 Virginia Avenue SW.

BARTLETT, COMDR. J. R. (John Russell), U. S. N., *a*.,
Providence, R. I.

BASSETT, C. C. (Charles Chester), *a*.,
Geological Survey. 929 New York Avenue.

BELL, A. GRAHAM (Alexander Graham), a.,
1336 Fifteenth Street.

BELL, CHAS. J. (Charles James), a.,
1487 Pennsylvania Avenue. 1825 Nineteenth Street.

BIES, JULIUS, a.,
199 Diana Street, New York, N. Y.

BIES, MORRIS, a.,
Geological Survey. Takoma Park, D. C.

BIERNE, CAPT. ROGERS, JR., U. S. A., a.,
Ordnance Office. 1341 New Hampshire Avenue.

BLAIR, H. B. (Herbert Buxton), a.,
Geological Survey. 153. F Street

BLODGETT, JAMES H. (James Harvey), a.,
Geological Survey. 1207 Massachusetts Avenue

BODFISH, S. H. (Summit H[illegible]), a.,
Geological Survey. 58 B Street N.E.

BOUTELLE, CAPT. C. O. (Charles Otis), a.,
Coast and Geodetic Survey.

BRAID, ANDREW, a.,
Coast and Geodetic Survey. 807 E. Cap. Street.

BREST, L. D. (Lawrence Decatur),
Geological Survey. 1324 Q Street.

BREWER, H. C. (Harrison Cl[illegible]), a.,
Hydrographic Office. Meridian Avenue, Mt. Pleasant.

BREWSTER, WILLIAM,
Cambridge, Massachusetts

BROWN, MISS E. V. (Elizabeth Virginia),
1112 S Street

BURTON, PROF. A. E. (Alfred Edmr), a.,
Massachusetts Institute of Technology, Boston, Mass.

CARPENTER, Z. T. (Zachary Tay[illegible]), a.,
1703 F Street. 1909 Thirteenth Street.

CHAPMAN, R. H. (Robert Hamilton), a.,
Geological Survey. 1807 L Street.

CHATARD, DR. THOS. M. (Thomas Maron), a.,
Geological Survey. 616 Park Avenue, Baltimore, Md.

CHRISTIE, PETER H. (Peter Harrison),
Geological Survey

CLARK, A. HOWARD (Alonzo Howard),
National Museum. 1527 S Street

CLARK, E. B. (Ellis Bockner), a.,
Geological Survey. Laurel, Md

COLVIN, VERPLANCK, a.,
Albany, New York.

COTTER, E. E. (Emil Edward),
Hydrographic Office. 491 Q Street.

CRAMER, R. D. (Robert Dodge), a.,
Geological Survey. 1[illegible] 01 Street.

Davis, W. M. (William Morris), Prof.
1111 Fourteenth Street. 1424 Q Street

Davis, Mrs. Caroline M. (Caroline Hendrey), Mrs.
1424 Q Street

Dawson, Cyril C. (Cyril Cecil), Lieut.
Coast and Geodetic Survey. 107 Harrow Road, Lt. Ewell, Surrey, England

Dawson, Percy, Mr.
Coast and Geodetic Survey. Takoma Park, D. C.

Davis, Arthur P. (Arthur Powell), Mr.
Reclamation Service. 814 M Street

Davis, Mrs. A. P. (Edmonia Brown Davis),
814 M Street

Davis, Prof. Wm. M. (William Morris),
Bussey Institution, Forest Hills, Mass.

Day, Dr. David T. (David Talbot),
Geological Survey. 624 Thirteenth Street

Dennis, W. H. (William Hopper), Lieut.
Coast and Geodetic Survey. 12 Lewis Circle

Dennis, J. S. (Joseph S.),
Geological Survey. 1414 Harvard Street

Dickens, F. M. (Edward Mortimer),
Geological Survey. Takoma Park, D. C.

Dow, James M.,
Panama Mail S. S. Co. Panama

Dyer, Basil,
Geological Survey. 477 L Street

Dickinson, A. F. (Abner F.),
Geological Survey. 701 A Street S.E.

Dimmick, John,
10 Rue Latrec, Paris.

Dutton, A. H. (Arthur Henry),
Hydrographic Office. 1305 H Street

Dutton, Capt. C. E. (Charles Edward), U. S. A.,
Geological Survey. 2029 R Street

Dyer, Lieut. L. (George Leland), U. S. N.,
Hydrographic Office. 1340 Twenty-fifth Street

Dyer, Mrs. W. (George Washington),
1003 F Street. 1307 Vermont Avenue

Dyson, J. R. (Joseph Ross),
1003 F Street. 1336 Connecticut Street

Elliott, Lieut. W. P. (William Porter), U. S. N.,
Navy Department. 1811 Q Street

Fairfield, G. A. (George Albert),
Coast and Geodetic Survey. 1417 Fifteenth Street

Fairfield, Walter H. (Walter Howe),
Coast and Geodetic Survey.

Fernow, B. E. (Bernhard Eduard),
Department of Agriculture. 1734 Nineteenth Street

FINLEY, LIEUT. J. P. (John Park), U. S. A., c.,
Army Signal Office. 1005 Twenty-fourth Street.

FISHER, E. C. (Ernest Calvert), c.,
Coast and Geodetic Survey. 410 New York Avenue.

FITCH, C. H. (Charles Hall), c.,
Geological Survey. 3615 N Street.

FLETCHER, L. C. (Lorin Clark), c.,
Geological Survey. 1811 F Street.

FLEXNER, DR. ROBERT, c.,
Army Medical Museum. The Portland.

FOX, W. C. (Worthington Cannery), c.,
State Department. 1325 H Street.

GALE, N. P. (Nathaniel P.), c.,
Scott's School.

GANNETT, HENRY, c.,
Geological Survey. 1801 Harewood Avenue, Le Droit Park.

GANNETT, S. S. (Samuel Simpson), c.,
Census Bureau. 621 Spruce Street, Le Droit Park.

GILBERT, G. K. (Grove Karl), c.,
Geological Survey. 1434 Corcoran Street.

GILMAN, PRES. D. C. (Daniel Coit), c.,
Johns Hopkins University, Baltimore, Md.

GOODE, G. BROWN (George Brown), c.,
National Museum. Lenox Hotel.

GORDON, R. B. (Richard Bygrave), c.,
Geological Survey. 1900 Seventh Street.

GREENHOW, EDWARD, c.,
Coast and Geodetic Survey. 7 Dupont Circle.

GORDON, R. O. (Robert O.), c.,
Geological Survey. St. Asaph Junction, Va.

GRAHAM, F. D. (Frank DeWolf),
[illegible]

GREELY, GEN. A. W. (Adolphus Washington), U. S. A., c.,
Army Signal Office. 1703 G Street.

GREENWOOD, W. T. (William Tudor), c.,
Geological Survey. 713 G Street.

GUTELIUS, F. P. (Frederic Philemon),
Geological Survey. 61 N Street.

HACKETT, MERRILL, c.,
Geological Survey. 420 Maple Avenue.

HARRISON, D. C. (Dabney Carr), c.,
Geological Survey.

HASKELL, E. M. (Edwin Martin),
Geological Survey. 1003 Fourteenth Street.

HASKELL, E. B. (Prospect Bowen), c.,
[illegible]

[illegible]
Office. 1862 Sixteenth Street.

Hayes, A. G., (Augustus George),
618 Seventeenth Street.

Hebert, A. J. (Alfred Judson), c.,
Army Signal Office. 474 B Street.

Henshaw, H. W. (Henry Wetherbee), c.,
Bureau of Ethnology. 18 Iowa Circle.

Herrick, Gustav, c.,
Hydrographic Office. 646 C Street NE.

Herron, W. H. (William Harrison), c.,
Geological Survey. 1400 B Street.

Hill, Geo. A. (George Andrew), c.,
Army Signal Office. 1348 Pennsylvania Avenue.

Hill, Prof. R. T. (Robert Thomas),
Austin, Texas.

Hinman, Russell,
Cincinnati, O. In care Van Antwerp, Bragg & Co.

Hopkins, Prof. H. L. (Howard Lincoln), c.,
Columbian University. 1531 Ninth Street.

Hopkins, C. L. (Charles Linsley),
Department of Agriculture. 1443 Chapin Street.

Hornaday, W. T. (William Temple), c.,
National Museum. 446 Spruce Street, Le Droit Park.

Howell, E. E. (Edwin Eugene), c.,
48 Oxford Street, Rochester, N. Y.

Howell, D. F. (David Jamey), c.,
909 F Street. Alexandria, Va.

Hubbard, Gardiner G. (Grant Gardiner), c.,
1 Connecticut Avenue.

Hunter, C. T. (Charles Thompson),
Coast and Geodetic Survey. 1330 I Street.

Ingersoll, J. H. (James Henry), c.,
Naval Hydrographic Survey. 902 H Street NE.

[illegible]
Treasury Department. 917 Maple Avenue, Le Droit Park.

[illegible]
Howard University.

[illegible]
917 Maple Avenue, Le Droit Park.

[illegible]
Coast and Geodetic Survey. 917 Maple Avenue, Le Droit Park.

Kaeb, Anton, c.,
Geological Survey. 1310 E Street, SW.

[illegible]
[illegible]

[illegible]
Howard University.

[illegible]
[illegible]
1325 Massachusetts Avenue.

Kennedy, George (L. L.,
Roxbury, Mass.

Kerr, M. J. (Mark Bickell), c.,
Geological Survey

[illegible]

[illegible]

Kimball, S. I. (Sumner Increase), c.,
[illegible]

King, F. H.
University of Wisconsin, Madison, Wis.

King, Prof. Harry, c.,
Geological Survey. 1319 Q Street.

King, William B.,
1618 Twenty-fifth Street.

King, Mrs. W. B.,
1328 Twenty-fifth Street.

Knight, F. J., (Frederick Jay), c.,
Geological Survey. 744 Eighth Street.

Knowlton, F. H. (Frank Hall), c.,
National Museum.

Koch, Peter, c.,
[illegible]

Lakeland, W. E. (William Eaton), c.,
Geological Survey. [illegible]

Lee, R. Burton,
Hydrographic Office. 1858 P Street.

Leech, R. L. (Robert Lee), c.,
Hydrographic Office. 849 Twenty-first Street.

Lindenkohl, Adolph, c.,
Coast and Geodetic Survey. 10 Fourth Street SE.

Lindenkohl, Henry, c.,
Coast and Geodetic Survey. 459 K Street.

Longstreet, R. L. (Robert Lee), c.,
[illegible] Survey. 1616 L Street.

Lovell, W. H. (William Henry),
Geological Survey. 24 0 Fourteenth Street.

Mather, W. J., c.,
Geological Survey. 1020 P Street.

Mcgee, Miss Mary C.,
[illegible]

Mcgee, W. J. (Willard Henry), c.,
Geological Survey. 1783 Rhode Island Avenue.

McKinney, R. C. (Robert Clifford), c.,
Geological Survey. 1231 Thirteenth Street.

Mahan, J. A. (James Arman), c.,
Johnson City, Tenn.

Manning, Van H., Jr. (Van Hartrop),
Geological Survey. Bramblewick, Md.

MARINDIN, H. L. (Henry Louis
Coast and Geodetic Survey. 1816 Rhode Island Avenue.

MARSH, ENS. C. C. (Charles Carleton), U. S. N., r.,
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MATTHEWS, DR. WASHINGTON, U. S. A., r.,
Army Medical Museum. 1362 New Hampshire Avenue.

MERRILL, CAPT. W. (George Washington), r.,
Engineer in Chief, U. S. N. Navy Department. 1705 B Street.

MERRIAM, CHF. ENG. A. C. (Alexander Caldwell), U. S. N.
Navy Department. 2013 Belmont Place.

MERRIAM, DR. C. HART (Clinton Hart), r.,
Department of Agriculture. 1940 Sixteenth Street.

MINDELEFF, CORNELIUS,
Bureau of Ethnology. 1439 Eleventh Street.

MINDELEFF, VICTOR,
Bureau of Ethnology. 3554 Fourteenth Street.

MITCHELL, PROF. HENRY, r.,
18 Hawthorne Street, Roxbury, Mass.

MORMAN, A. T. (Alonzo Tyler), r.,
Coast and Geodetic Survey.

MOULTHROP, ROBERT, r.,
Geological Survey. 1412 Fifteenth Street.

MUNSELL, A. E. (Arlington Elliott),
Geological Survey. 1530 Third Street.

MYERS, MRS. IDA A. (Ida Agnes Gilbert),
1 [illegible] Street.

NATTER, E. W. F. (Ernst Wilhelm Franz),
Geological Survey. 474 Pennsylvania Avenue.

NEAL, JOHN, r.,
Geological Survey. 1118 Virginia Avenue S. W.

NILES, W. H.,
Massachusetts Institute of Technology, Boston, Mass.

NORTHROP, CHARLES, r.,
703 K Street.

OLIVER, H. C. (Herbert Crompton), r.,
Coast and Geodetic Survey. 1834 Nineteenth Street.

PARSONS, F. H. (Francis Henry), r.,
Coast and Geodetic Survey. 910 First Street SE.

PATTON, PROF. W. W. (William Weston), r.,
Howard University. 423 College Street.

PEALE, DR. A. C. (Albert Charles), r.,
Geological Survey. 1446 Stoughton Street.

PERKINS, E. T., Jr. (Edmund Taylor), r.,
Geological Survey. 1891 F Street.

PERRIER, M. A. P.,
Austin, Texas.

PETERS, LIEUT. G. H. (George Henry), U. S. N., r.,
Navy Department.

Abbott, W. J. (William James), ... Geological Survey 1341 F Street.

Abbott, James L., ... Geological Survey 1810 G street

Abbott, Miss [illegible] ... Geological Survey 810 M Street

Abbott, Miss W. H. (William Hemsley), ... Franklin School Building 1730 Twelfth Street

Abbotts, Dr. D. W. (Daniel Webster), ... 1101 Fourteenth Street

Abercrombie, Jno. H. (John Henry), ... Geological Survey 1124 I Street

Abercrombie, F. [illegible], ... Seattle, Washington Territory

Adler, Dr. C. (Cyrus), ... Department of Agriculture 1708 Thirteenth Street

Adler, H. P. (Henry Phineas), ... [illegible] Geological Survey 1135 Seventeenth Street

[illegible] ... [illegible] Capitol, ...

[illegible] ... Geological Survey 1704 Connecticut Avenue

Agassiz, [illegible] ... [illegible]

Agassiz, Mrs. H. (Samuel Hubbard), ... Cambridge, Massachusetts

Agassiz, Prof. A. (Alexander), ... Cambridge, Massachusetts

Albert, J. [illegible] ... [illegible] 1001 Eighteenth Street, La Grand Park

Smith, [illegible] ... Coast and Geodetic Survey 2[illegible] 14th St. N.W.

Smith, Miss [illegible], ... Army Medical Museum 1703 Fourteenth Street

Smith, F. J. (Francis Jarvis), ... Coast and Geodetic Survey 1461 A Street S.E.

Stein, Theodore, ... Geological Survey

Stejneger, Leonhard, ... [illegible]

Stejneger, Mrs. L. H. (Charlotte Haberle), ... Navy Department [illegible] Sixth Street

Stetson, Frank, ... Geological Survey 1836 K Street

Thomas, Miss Mary Lee (Mary Lee Eyster), ... Coast and Geodetic Survey 1[illegible] Sixth Street N.E.

THOMPSON, PROF. A. H. (Alpon Harris), a.,
Geological Survey

THOMPSON, GILBERT, a.,
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THOMPSON, LAURENCE, a.,
Box 588, Seattle, Washington Territory

THOMPSON, LIEUT. R. E. (Richard Edward), U. S. A., a.,
War Department. 901 N Street.

TITTMANN, O. H. Otto Hilgard), a.,
Coast and Geodetic Survey. 16 V Twentieth Street

TOWNER, R. M. (Richard Mathew), a.,
Geological Survey 834 Thirteenth Street.

TRENHOLM, HON. WM. L. (William Lee), a.,
American Surety Company, 100 Broadway, N. Y

TWEEDY, FRANK, a.,
Geological Survey

TYRRELL, CHAS. F. (Charles Fox), a.,
Geological Survey 404 Seventeenth Street

VASEY, DR. GEORGE, a.,
Department of Agriculture 3013 Fourteenth Street

VINAL, W. I. (Washington Irving), a.,
Coast and Geodetic Survey 108 L Street SE.

VON HAAKE, ADOLPH,
Post Office Department. 1313 L Street.

WALCOTT, C. D. (Charles Doolittle), a.,
Geological Survey 418 Maple Avenue, Le Droit Park.

WARD, HON. [illegible] (Hamilton Mercer), a.,
Geological Survey, 2016 G Street.

WARD, LESTER F. (Lester Frank), a.,
Geological Survey. [illegible]

WEED, WALTER H. (Walter Harvey),
Geological Survey 935 Vermont Avenue.

WHITE, J. B. (John Bradford), a.,
1015 L Street

WILLARD, DR. J. C. (James Clarke), a.,
903 Connecticut Avenue

WHITE, DR. C. A. (Charles Abiathar), a.,
Geological Survey 818 Maple Avenue, Le Droit Park

WILDE, DR. C. L. (Charles Henry), U. S. N., a.,
Navy Department

WHITING, LEROY L. (Henry Laurens),
Coast and Geodetic Survey West Tisbury, Mass.

WILDER, GEO. J. T. (John Thomas), a. f.,
Johnson City, Tenn.

WILDER, MISS MARY,
Johnson City, Tenn.

WILLIS, BAILEY, a.,
Geological Survey 1014 R Street.

WILLIS, MRS. BAILEY (Alice H. Grinnell), 1315 K Street.

WILSON, A. E. (Adolphus Irwin), Geological Survey. 931 G Street.

WILSON, H. M. (Herbert Michael), c., Geological Survey. Cosmos Club.

WILSON, THOMAS, National Museum. 1218 Connecticut Avenue.

WINSTON, ISAAC, Coast and Geodetic Survey. 1325 Corcoran Street.

WOODWARD, R. S. (Robert Simpson), c., Geological Survey. 1901 Columbia Road.

YARROW, DR. H. C. (Harry Crecy), U. S. A., c., Army Medical Museum. 814 Seventeenth Street.

YEATES, CHAS. M. (Charles Marion), c., Geological Survey. 1304 K Street.